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HIGH-TEMPERATURE MEASUREMENTS.

The introduction of the electric furnace into many processes has undoubtedly emphasized the desirability of more accurate methods of measuring high temperatures. In addition to this, electrical methods have made possible the more accurate determination of such temperatures, and have also given to us several types of pyrometers which may be used when the old thermometers are unavailable, and which, besides having certain advantages of their own, have extended the scale of temperature measurements considerably. We are now able to produce high temperatures under conditions such that there are few disturbing factors, and we are also able to carry these temperatures very much higher than when the main dependence was placed upon heat produced chemically. These conditions made more necessary accurate temperature measurements, and made desirable the determination of a temperature scale by means of which pyrometers might be properly calibrated.

For low temperatures the gas thermometer may serve as a primary standard by means of which definite temperatures, such as the melting points of various metals, are determined; which are, in turn, used for calibrating pyrometers in much the same way as the boiling point of water and the melting point of ice are used for ordinary thermometer testing. Above the point where the air thermometer may be used satisfactorily, other means must be adopted, and these are generally applications of the physical laws of Wien and of Stefan and Boltzmann. These define the radiation from a hot body in terms of its temperature, so that, accepting the laws as true, and measuring, in the one case, the radiation of any monochromatic beam of light, and in the other, the total radiation, the temperature of the body may be estimated. For such measurements it becomes, therefore, a question, not of measuring the temperature, but of measuring the radiation.

A good deal of work has been done in this field of late, though much more remains yet to be done. The present state of the art was interestingly described at the recent meeting of the American Electrochemical Society in an instructive paper presented by G. K. Burgess. A point of practical importance established is that it is not difficult now to calibrate a pyrometer satisfactorily by means of the melting points of various metals with the materials easily procurable in this country. The variation in temperature obtained in this way, at least up to about 1,000 degrees centigrade, should not be more than a small fraction of one per cent. Above these points the condition is not quite as satisfactory, but the difficulties here are being overcome, and the melting points of the more infusible metals,

such as palladium and platinum, are now being satisfactorily fixed. The work so far has shown, however, that there is some uncertainty respecting the constants now used in applying these laws, so that further work should be done in determining them or in modifying the formulæ, if found necessary. For high-temperature measurements the application of these laws is, of course, an extrapolation, and is based upon the acceptance of the law as true. Discrepancies at high temperatures are therefore more likely to be observed. On the other hand, an increase in the range of application of the law will enable the constants to be determined more accurately. In such work it is, of course, very important that a comparison should be made of temperatures as determined by means of the two laws.

The conclusions reached by Mr. Burgess are that although the conditions at present are not altogether satisfactory from a scientific standpoint, practically we have reached a satisfactory stage, at least for all work except at the very highest temperatures. It is not improbable that before long it will be possible to calibrate certain pyrometers accurately, and in a short time, up to a temperature of at least 3,000 degrees centigrade.

ACCURACY IN PHOTOMETRIC WORK.

The photometrist is to-day laboring under a number of difficulties, some of which are inherent to the work itself, and others due to the stage of development which has now been reached in the art of measuring light. The first great difficulty is due to the limitations of the human body. Some observers are not capable of as accurate work as others, and even the latter find that the quality of their work varies from time to time. For practical purposes—that is, for every-day use—the adaptability of the eye is all important. We are capable of working in comfort and effectively with illuminations varying greatly in intensity. The eye is so constructed that it automatically protects itself against excessive light, and although the illumination in the workroom may vary through wide ranges, the variation in the amount of light entering the eye is, within certain limits, much less. It seems likely, however, that this very property of the eye is one which makes photometric measurements—that is to say, accurate comparison of different luminous sources—difficult, for if the pupil of the eye did not contract and expand, the eye itself would feel more quickly any change in luminous intensity, and thus be able to detect more readily slight changes when making photometric measurements. This idea seems to be borne out by the practice followed by some, of reducing the luminous intensity of the surface viewed to a low degree, or else of cutting off a large amount of the light which would otherwise enter the eye, and thus practically comparing surfaces faintly illuminated, so that they do not tend to contract the pupil.

The other class of errors is that due to the apparatus employed for making photometric comparisons. There are various types of photometers utilizing different effects to detect differences in illumination. These, of course, have their own defects, some being more sensitive than others. But a more troublesome problem than that of obtaining a satisfactory photometer is the construction of a reliable standard of light. At the present time there are three standards in use, the relative values of which are fairly accurately known, but not so accurately as is desirable. With a view to throwing some light on this matter, and also of determining how closely the unit of light adopted by the Bureau of Standards at Washington compared with the primary standards from which it was supposed to be drawn, Dr. E. P. Hyde last year took over to Europe with him eighteen incandescent lamps which had been carefully tested and rated at the Bureau's laboratories. The standard, or rather the unit of radiating power, adopted by the Bureau of Standards is the candle-power, but on account of the unreliability of the British candle as a primary standard, this value was determined by adopting a certain ratio as compared with the Hefner-von Alteneck amyl-acetate lamp used as the standard in Germany. The ratio adopted is, one hefner unit is equal to 0.88 British candle, and this is preferably known as the unit, rather than a standard. It was with this ratio that the lamps taken to Europe were standardized.

These lamps were taken to England, France and Germany, back to England, and back to Washington. In each country they were compared with the official standards. The results thus obtained are given and discussed in a very interesting article published by Dr. Hyde in the April issue of the *Bulletin of the Bureau of Standards.* The lamps were divided into two sets. Those of one were rated in a fixed position, while the others were rotated and rated for mean horizontal candle-power. The latter method is open to some objections. Rotation at 180 revolutions a minute or less does not entirely eliminate flickering, and the reflection of the filament from the bulb is troublesome. Moreover, the filaments may be somewhat distorted by the motion of the lamp. The latter is particularly true if higher speeds be employed. The results of the measurements as a whole show that although there are some slight discrepancies in the ratios between the three standards of light which have been adopted, and that the results obtained by rotating the lamp are not in as close agreement as those given by the stationary lamps, that still the errors are so small as to be commercially negligible. Scientifically, however, these discrepancies are large enough to warrant examination, with a view to locating the source of trouble.

The figures given by Dr. Hyde showing the accuracy of the different observers are interesting. It was found that the greatest deviation made by any observer from the mean value, with the stationary lamp, was only 0.7 per cent; with the rotating lamp it was 1.2 per cent. The average deviations were 0.3 per cent and 0.5 per cent, respectively. These deviations, of course, are insignificant practically, but it should be borne in mind that the measurements were made under the most favorable conditions, and by men who had been carefully trained in this work. Commercial photometry can, of course, lay no claim to any such accuracy.

The most important result of the work conducted by Dr.

Hyde is that which enables a comparison to be made between the different standards used in England, France and Germany. The former country uses the Harcourt pentane lamp, and rates it at ten British candles. France employs the Carcel, which is approximately equivalent to the Harcourt standard. The German standard is, of course, the Hefner lamp, which has a value of something less than 0.9 of a British candle. By comparing the ratings of the different lamps made by the different laboratories it is possible to deduce the ratio of the various standards. This has been done, and it is shown that in some of the ratios there is an uncertainty amounting to several per cent. On account of this Dr. Hyde urges the desirability of adopting some international unit of light at this time; for as the science of photometry advances, the work will be done more accurately, and it will become harder and more inconvenient to make any change in the ratings of the accepted standards. On account of these discrepancies, also, he suggests that the unit employed in this country be known as the "candle," not the "British candle," as there is a difference of about two per cent in the value used here and that employed in England. A table is given showing the most probable ratios of the three standards. These ratios, adopting the Hefner as unity, are 11.4 for the Harcourt and 10.87 for the Carcel. It is pointed out that this method of obtaining these ratios—that is, by comparing each standard with an incandescent lamp, and then comparing these measurements—gives more accurate results than could be obtained by comparing the standards directly, as the latter are so greatly affected by external conditions. The unit employed in this country, which is determined by taking the hefner unit as 0.88 of a candle, as has already been mentioned, was found to differ by two per cent when compared with the Harcourt lamp at the National Physical Laboratory, London, but when compared with any Harcourt lamp the difference may be as much as five or six per cent. Such a discrepancy is unfortunate, in a way, although if the method of derivation of the Bureau's unit be borne in mind, this objection is not so important. It is important, however, to bear in mind that the value of the candle used in this country differs so much from the British candle as defined in England. This is particularly true when making any comparison, and it emphasizes the desirability of carrying out some such suggestion as that made by Dr. Hyde, that even though we are not as yet able to construct a primary standard of light which will satisfy all countries, we could adopt a unit of light, by means of which measurements made in the different countries could be compared.

SMOKE PREVENTION.

Among the many reforms that have been instituted in city governments, the elimination of certain nuisances, such as the prevention of smoke, has received an unusual amount of attention. Heretofore no attempts were made to overcome this annoyance, it being taken as a necessary city evil. Even in those cases where smoke ordinances were passed, they became dead letters in a short time. Now, happily, a brighter era is dawning, and the production of smoke in any of our larger cities is sure to bring the producer into disrepute, and often into the clutches of the law.

To prevent smoke, of course, the proper method is to use suitable furnaces. This can be done at a slight expense, and does not inconvenience the coal burner in any other way; in fact, it usually means that a more economical method of firing and combustion has been introduced.

However, even with the best furnaces, some smoke will, at times, be given off. As a rule, this is not enough to be objectionable, but, if necessary, even this might be prevented. A recent note in *Nature* (London) by Mr. G. W. Walker suggests how this might be done. Mr. Walker has made use of an effect noticed some years ago, namely, that dust and soot are attracted by bodies positively charged. He has used this effect for removing soot from air used for ventilation purposes. The pressure required is not high, one to two hundred volts being sufficient; and this is always obtainable in large cities. Where prevention of all smoke is very desirable, no doubt this idea could be employed to supplement the use of proper furnaces. The power required is trifling. The only expense is that necessary to pass the smoke through wire screens connected to the electrical supply. The solid particles are deposited on the screen charged positively, and the latter could be arranged so that cleaning could be frequent and easy.

THE CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Present indications point to a most successful meeting on the occasion of the thirtieth convention of the National Electric Light Association, Washington, D. C., June 4, 5, 6 and 7. The capital city has a charm for those who have never before visited it and know of its allurements only by description and illustration, but with those who have once been within its confines there always remains a longing to return. The valuable papers which are indicated for presentation in the programme, and, particularly, the elaborate layout for "New Business Day," Friday, June 7, will call forth a big representation from the central stations. The manufacturers' exhibit, which, it is announced, will be very complete, will bring out the usual jovial, wholesouled aggregation of representatives who do much to make these conventions successful. The Atlantic City convention, last year, was notable for the presence of so many of the womenfolk, but it is expected that this year's representation will eclipse any heretofore in attendance. The entertainment programme, notice of which is given on another page of this issue, is attractive, and already we hear of many, both central station men and manufacturers, who will be accompanied by their families.

Aside from any recreation or physical enjoyment, however, there are many real, serious reasons why every central station man should avail himself of this annual opportunity to get in touch with those who may help him solve many problems. President Williams and his committees have been working hard to demonstrate these advantages to those who have not joined the association, and their efforts are meeting with great success.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

A FINE ENTERTAINMENT PROGRAMME ARRANGED—THE EXHIBITORS.

The preliminary programme of the business sessions of the thirtieth convention of the National Electric Light Association, to be held at the New Willard Hotel, Washington, D. C., June 4, 5, 6 and 7, indicates a strenuous time for those attending the meeting for instruction and profit. In addition to the long list of papers, however, the entertainment committee has prepared a number of enjoyable trips, mostly for the ladies, in and about Washington, and other features in which the men may join to make "life seem more like a holiday."

PROGRAMME OF ENTERTAINMENTS.

On Tuesday morning there will be a two-hour automobile trip for the ladies.

On Tuesday afternoon a special reception will be given by President Roosevelt. In the afternoon there will be car rides to Cabin John, stopping for an hour at Glen Echo. In the evening there will be a theatre party at the Columbia theatre for the ladies.

On Wednesday morning there will be another automobile ride for the ladies. In the afternoon there will be an exhibition cavalry drill at Fort Meyer. The ladies are invited to attend the lecture by Dr. Steinmetz in the meeting hall at 8:30. There will be a ball in the small ballroom at the New Willard at 9:30.

Thursday morning there will be an automobile ride for the ladies. In the afternoon a visit will be made to Mount Vernon, going by boat. In the evening the ladies will visit the Congressional Library and other points of interest.

On Friday, in the morning, the ladies will make another automobile trip, and in the afternoon there will be visits to the National Museum and Corcoran Art Gallery.

The exhibition promises to be a great success. Nearly all of the seventy-eight booths have been taken. Many of the companies will have working exhibits. Arrangements have been made to decorate the exhibit hall, which will, of course, add to the attractiveness of the various booths. The following associate members will take part in the exhibition:

American Electric Heater Company, Allis-Chalmers Company, Harold P. Brown, American Instrument Company, W. J. Barr Electric Manufacturing Company, Crocker-Wheeler Company, Crouse-Hinds Company, Curtis Advertising Company, Dearborn Drug and Chemical Company, Dossert and Company, Electric Storage Battery Company, ELECTRICAL REVIEW, *Electrical World*, Federal Electric Company, Fibre Conduit Company, Fort Wayne Electric Works, Francis Raymond (Sheldon School), Franklin Electric Manufacturing Company, General Electric Company, John L. Gleason, Jandus Electric Company, H. W. Johns-Manville Company, C. W. Lee Company, Metropolitan Engineering Company, M. O. Publishing Bureau, National Electrical Supply Company, National Electric Lamp Association, New York Beck Lamp Company, Oneida Community, Limited, Pettingell-Andrews Company, Philadelphia Electric and Manufacturing Company, Pittsburg Transformer Company, Pope Motor Car Company, Simplex Electric Heating Company, Standard Paint Company, Standard Vitrified Conduit Company, Southern Exchange Company, Telelectric Music Company, Wagner Electric Manufacturing Company, Western Electric Company, Westinghouse Companies, Weston Electrical Instrument Company.

General Electric Company Meeting.

The annual meeting of the stockholders of the General Electric Company was held at Schenectady, N. Y., on May 14. The following directors were elected: Gordon Abbott, Oliver Ames, T. Jefferson Coolidge, Jr., Frederick P. Fish, George L. Gardner, Henry L. Higginson, Robert Treat Paine, 2d, of Boston; C. A. Coffin, J. Pierpont Morgan, S. L. Schoonmaker, Charles Steele, of New York; W. M. Crane, Dalton, Mass.; Marsden J. Perry, Providence, R. I.; J. P. Ord, Albany, and E. W. Rice, Jr., Schenectady. Marsden J. Perry was elected to succeed the late General Eugene Griffin as first vice-president, and S. L. Henderson to succeed T. K. Henderson, resigned.

On May 15 at the directors' meeting in New York, the following officers were elected: C. A. Coffin, president; A. W. Burchard, assistant to the president; vice-presidents—E. W. Rice, Hinsdill Parsons, B. E. Sunny, J. R. Lovejoy; M. F. Westover, secretary; H. W. Darling, treasurer and assistant secretary; I. S. Keeler, second assistant secretary; H. P. Schuyler, assistant treasurer; Edward Clark, general auditor; John Riley, assistant general auditor; S. L. Whitestone, assistant general auditor.

The duties of the various vice-presidents remain the same as before the election.

The stockholders voted to approve the change in the by-laws providing that hereafter no officer of the company except the president need be a member of the board of directors.

Indianapolis Meeting of the American Society of Mechanical Engineers.

The semi-annual meeting of the American Society of Mechanical Engineers to be held in Indianapolis, Ind., May 28 to 31, promises to be of especial interest to mechanical engineers. A wide range of subjects will be taken up and discussed, among which will be reports of committees on standard proportions for machine screws; standard tonnage basis for refrigeration, and papers on pumping engines, the heating of storehouses, and kilns for Portland cement; special sessions for papers and discussions of superheated steam, including papers on its specific heat, its flow, furnace and superheat relations, the determination of entropy lines for superheated steam, the performance of Cole superheaters, superheated steam in an injector; the use of superheated steam on locomotives in America, analysis of locomotive tests, and material for the control of superheated steam.

An automobile symposium has been planned for the Wednesday evening, May 29, session, at which papers, illustrated by lantern slides, on ball bearings in general and their use on automobiles in particular, air cooling of automobile engines, materials for automobiles, special automobile steel, and the railway motor car will be read and discussed. These papers have been prepared by authors who have made important investigations in their particular lines of work.

Accommodations for transportation and Pullman car service can be arranged for by addressing the secretary of the society. Several excursions have been arranged to different plants and points of interest in and around Indianapolis. One of the professional sessions devoted to superheated steam will be held at Purdue University, and an opportunity will be given the guests after the session of going over the university. The local committee at Indianapolis is endeavoring to secure reserved seats for those attending the convention, upon the occasion of President Roosevelt's speech at Indianapolis on Decoration Day. On Wednesday afternoon, May 29, a visit will be made in special cars to the Atlas Engine Works, and the National Motor Vehicle Company. Another excursion on the same afternoon has been arranged for the D. N. Perry Manufacturing Company, and to the Nordyke & Norman Company.

A NEW GOVERNMENT PORTABLE WIRELESS TELEGRAPH APPARATUS.

BY R. H. WHITE.

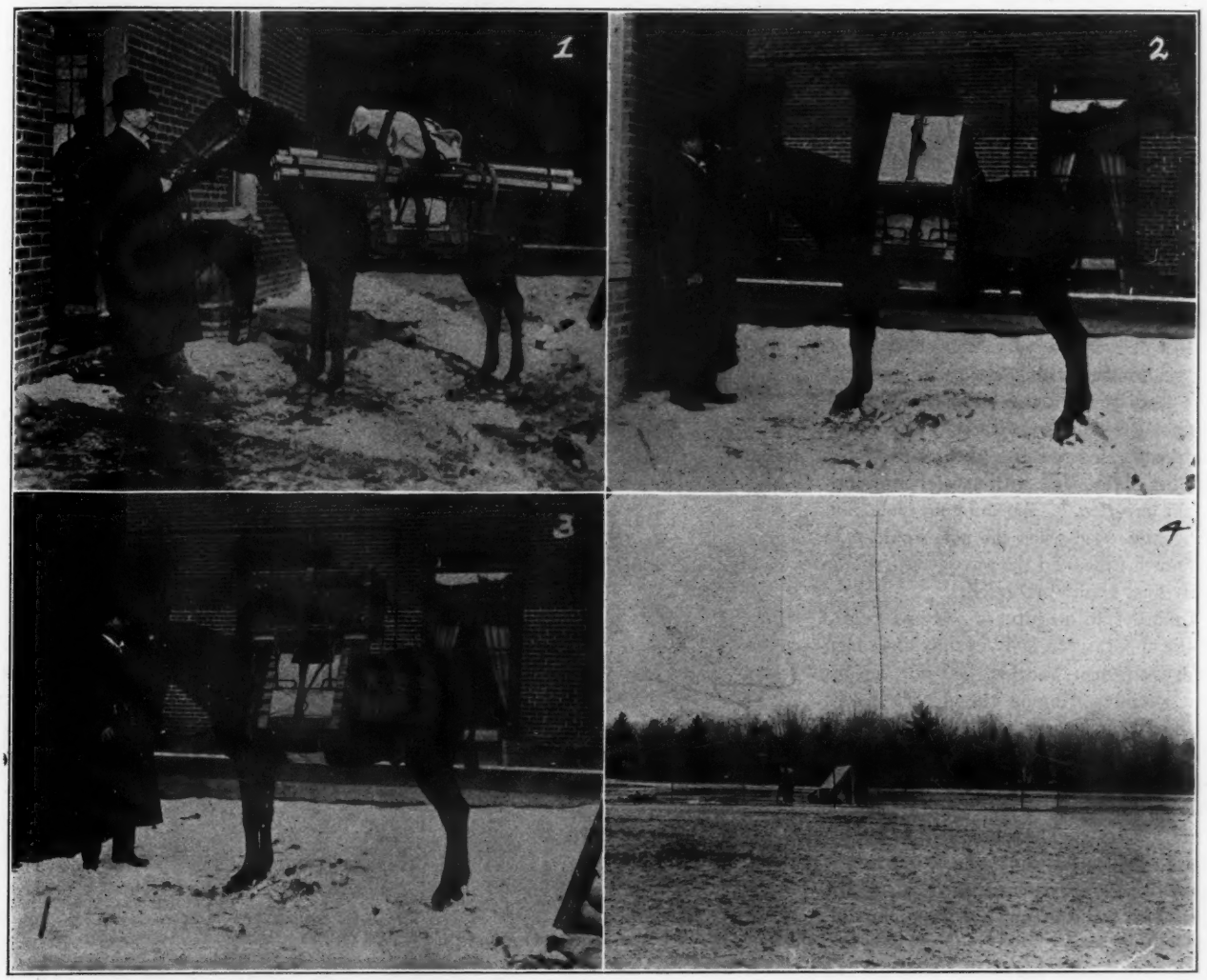
When you read the word "wireless" you think of a stationary electric plant, a building with receiving and transmitting apparatus, one or more towering masts with an extensive guy rope system. Nevertheless, a wireless outfit which can be packed upon the backs of three mules, and regular army mules, at that, is an accomplished fact. For some time the Signal Office has been experimenting and constructing and has now evolved a type of instrument which for compactness, strength and reliability goes far beyond the expectations of those whose idea of a wireless outfit is confined to some such outline as is given above.

The instrumental part of the outfit—that is, the key, detector, condensers, tuning coil, etc., etc., are permanently fastened into and carried in a trunk, little larger than an ordinary steamer trunk, and weighing, complete, about one hundred and fifty pounds. Two storage batteries, sufficient for ten hours of continuous sending, are provided, in wooden cases, which are used as supports for the trunk when the outfit is unpacked. A mast is used, made up of ten six-foot sections, jointed together and held in position by guys. Along these sections runs a copper strip which makes electrical connection with its neighbor when the joint and socket ends are fitted each to each.

The load is apportioned as follows: One mule carries the trunk and the instruments therein, one mule carries the two batteries, and one the ten lengths of mast together with a bag containing extra ropes, wire, pegs, etc. The entire outfit is thus packed on three mules; while in service a tent would undoubtedly be used to protect the outfit from rain and dust, it can not be considered that a tent forms an integral part of the apparatus any more than it does so form part of any other outfit of communication used by the Signal Corps.

These outfits are packed upon the mules in the same aparejo (aparayo) that is used throughout the army for fastening to the back of the mule supplies of all kinds. The pictures of the mules with the apparatus on their backs show them as they were first tried, the man being Mr. Daly, chief packer of the United States Army who, it is said, knows more about what to put on a mule and how to make it stay there than any other man alive.

The outfits are designed for the hardest kind of field work, and while yet and for a long time to come, nothing connected with wireless telegraphy can be truthfully recorded reliable, these outfits are as reliable as any—partly on account of their simplicity and partly on account of the



UNITED STATES SIGNAL CORPS PORTABLE WIRELESS TELEGRAPH APPARATUS. 1.—MULE WITH JOINTED ANTENNÆ AND TENT. 2.—MULE WITH STORAGE BATTERIES. 3.—MULE WITH SENDING AND RECEIVING OUTFIT. 4.—RAISING THE SECTIONAL ANTENNÆ.

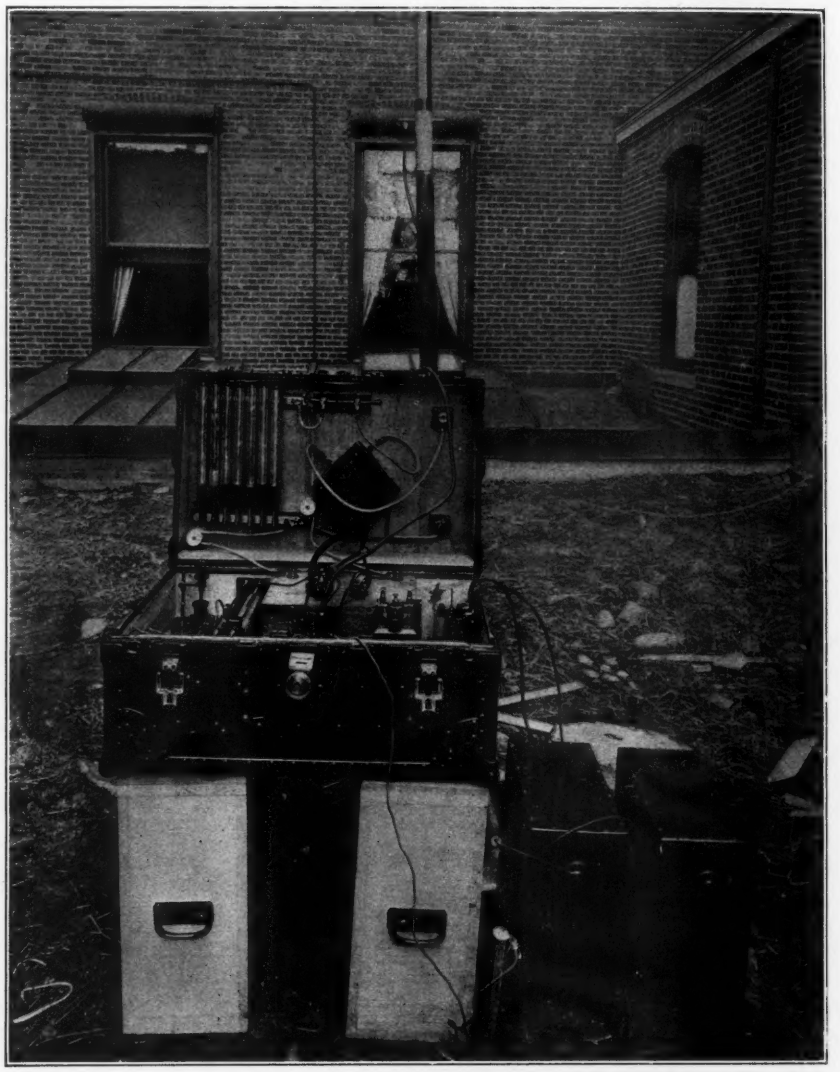
great care and pains taken in their construction. They have a sending and receiving radius to sister stations of from fifteen to twenty-five miles. The wireless outfit provides the possibility of a detached body of men being in constant communication with the main body, across an enemy's line if need be, and with no possibility of interruption save an attack on the party itself.

A charging station is a necessity and this is provided in the form of a gasoline engine and generator unit, weighing three hundred pounds and which is to be transported in the wagon train which is inseparable from the movement of a large body of men over an extended area. This unit is strongly and serviceably built within a heavy pipe frame, to prevent damage from blows and knocks, and can be used not only for charging batteries but for supplying the current used in sending messages from headquarters. Further than this, a generator worked by man power is provided, for smaller columns, and which serves very well, but is, of course, somewhat exhausting to the men who have to turn the cranks and which has not the capacity of the power plant.

Recently the wireless outfit was tested at Fort Myer, Va., with special reference to the erection of the antennæ pole, the King kite, used when the pole would take too much time, and the wave length of the individual apparatus tested.

In order to accentuate the bad points of the apparatus, a body of untrained men were used, men who had had no previous practice in erecting an antennæ mast. In spite of this drawback, the mast went up in little less than three-quarters of an hour, a time which can be reduced to fifteen minutes and very possibly much less, with practice. The operation is as follows: Along the topmost section of the mast the top guys are wound, on hooks, and these are first unwound and laid out at right angles on the ground. These topmost guys, by the way, are of wire for half their length, and leakage is guarded by double insulators where the connection is made with woven cord. These four wires spreading from the top form an umbrella antennæ. The top pole is fitted to the pole next below it and these two raised in the air and a third slipped into place. The pole is held upright by four men at the ends of the four guys. Here another set of plain cord guys, also doubly interrupted with insulators, comes into play, which is taken in charge by four additional men. Three more sections are pushed up, one after the other, and then four more guys, making twelve in all, are attached, and pulled taut by four more men. The last two sections are pushed home and the mast stands, somewhat insecure in appearance and bent and twisted, but it stands. It is but the work of a few moments to so order pulling and slackening on several guys that it stands straight —when two men, with pegs and an axe, fasten the guys securely to the ground. Meanwhile a tent has been erected close to the mast, the trunk lifted from the aparejo and placed on top of the two empty boxes in which were the storage batteries. A ground antennæ is spread to four small poles and guys, an electrical connection made between apparatus and mast with insulated cord, and the apparatus is ready for work, either in sending or receiving.

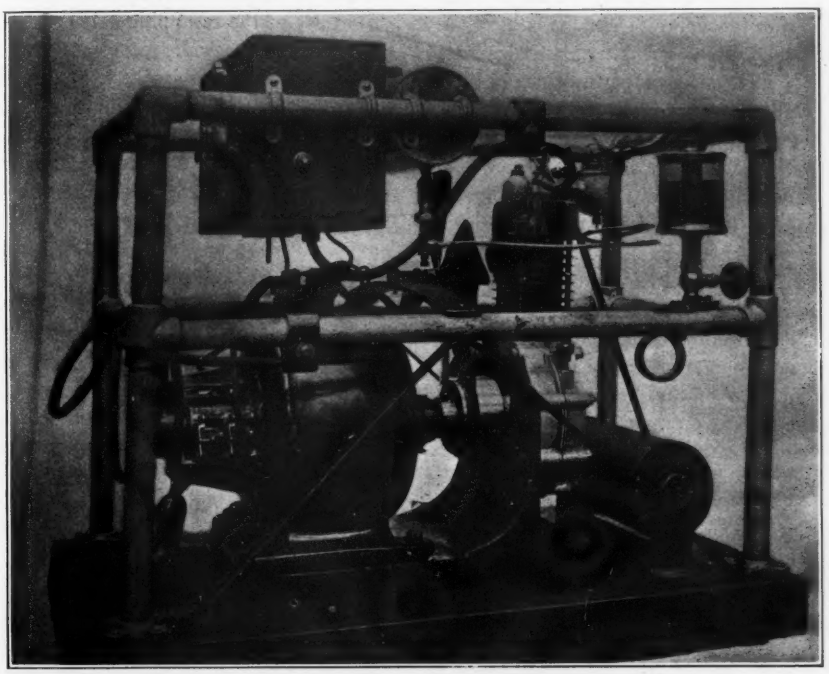
While limited in radius on account of both power and elevation where sister stations are concerned, there is no difficulty in getting into communication with large stations, such as Henry or Navy Yard or Sandy Hook, over a distance of one hundred miles and even more. This provides for the possibility of relaying a message to a sister station out of range of the original sender but in range of the more powerful if more distant station which could be in communication with both small stations.



PORTABLE WIRELESS TELEGRAPH APPARATUS DEVELOPED BY THE UNITED STATES SIGNAL CORPS FOR FIELD SERVICE.

It happens at times in such work that it is necessary to open communication in the least possible time. This can be done, if there is a slight breeze, by the use of a kite. The kite used in the Signal Corps is called the King kite, from the sergeant who invented it—a combination Malay and box kite, without a tail, very steady in a slight breeze as well as a wind and extremely compact. The kites are either

six by six feet or eight by eight feet, have two stretchers from top to bottom and one from side to side, which last is removable by unhooking sockets and untying two cords. When this is taken out and laid lengthwise with the other two stretchers, the kite rolls up in small space, and can be instantly erected without any tools, by merely reinserting the cross-stretcher and tying in. The kite cord is composed of forty-two strands of phosphor-bronze wire, woven about a hemp centre. It serves itself as the antennæ when carried up by the kite. It works well if five hundred feet have been paid out—better if the wind carries up more. This wire cord is wound on a hand reel. The kite itself is flown from a bridle which is attached to the cord. The kite has a boxed-in space of a triangular pattern, a compression release opening, and is yet shaped like the familiar six-sided Malay kite.



PORTABLE GASOLENE ENGINE AND GENERATOR FOR WIRELESS TELEGRAPH FIELD SERVICE.

A number of these wireless sets, each one slightly different from its predecessors, as improvements were suggested, have been issued and sent to various posts and commands. There will be a number yet made and distributed, all of the most recent, trunk-contained pattern, and they will be largely used in army maneuvres, which will put the final test to their arrangement and construction.

The spark is about a quarter of an inch in length, varying, of course, with the strength of the current, the distance to which the message is being sent, the spread of antennæ, etc. It springs from between two brass electrodes plainly seen in the illustration. The detector generally used is the electrolytic, in which a piece of platinum wire is drawn in silver and the silver coating eaten away by the acid with which the tip of the wire is in contact in a small cup in the form of the detector here used. In spite of the fact that the constant filling and emptying of this cup is necessary as the outfit is moved, the simplicity and reliability of this detector has recommended it to the Signal Corps over others, although others have been and are being used, and will be experimented with as fast as they are brought out.

The principal condenser is of the Leyden jar type, and is plainly to be seen on the inside of the trunk cover to the left. There are eight in this set, but here, again, the number of tubes, and size and capacity of the condenser varies with the general style and capacity of the apparatus.

The tuning coil for receiving messages is of copper wire on a rubber centre—the tuning coil for sending messages is of rubber-covered wire. The first is in the trunk to the left, partly seen, with the tuning traveler above it—the second coil is about the square rubber support on the lid of the trunk inside, to the right.

The induction coil is specified as taking eight amperes at sixteen volts when the interrupter is working.

While the apparatus can be seen by any one interested, in the laboratory of the Signal Corps, at Washington, very exact details, and anything approaching a working drawing is withheld, for obvious reasons, although there is nothing secret about this construction. The whole matter is yet in so much of an experimental state, although the present instruments are highly satisfactory, that no definite data has been or will be furnished as yet as to minute constructive particulars.

Annual Congress of Manufacturers.

The National Association of Manufacturers held its twelfth annual convention and banquet on May 20, 21 and 22, at the Waldorf-Astoria Hotel, New York city. Parts of three days were devoted to the business sessions of the convention, during which addresses were made on some of the most important topics now before the business world by government officials, manufacturers and others prominently identified with these subjects. The annual banquet was held on the evening of Wednesday, May 22.

Among the speakers announced for the business sessions were:

Hon. Charles A. Prouty, of the Interstate Commerce Commission, on "Further Railroad Legislation."

Hon. Francis B. Loomis, formerly Assistant Secretary of State, "Some Practical Results of the Convention Reform Agitation."

Charles M. Pepper, special agent of the Department of Commerce and Labor to investigate trade conditions in foreign countries, on "Foreign Trade: How to Get It and Keep It."

Dr. Charles P. Neill, Commissioner of Labor, Department of Commerce and Labor, on "Certain Aspects of the Child Labor Problem."

Arthur D. Dean, on "Trade Schools; the Manufacturer's or the Pedagogue's Sort."

Captain Henry A. Castle, late Auditor of the Treasury for the Post-Office Department, on "Needed Postal Reform."

The chief speakers at the banquet were: Hon. Oscar S. Straus, Secretary of Commerce and Labor; Senator J. P. Dolliver, of Iowa, on "The Revolt of the Unincorporated"; Rear-Admiral Charles D. Sigsbee, for the Navy; Major-General J. Franklin Bell, chief of staff, for the Army, and Rev. Dr. Joseph Dunn Burrell, on "The Era of Work."

DEPRECIATION.[1]

BY ROBERT HAMMOND.

In arriving at the net profits earned during any given period by an industrial undertaking, it is obvious that a determination should be made of the extent to which the assets of the undertaking have depreciated in value during that period. Where machinery and apparatus are employed it is necessary to estimate their probable "life," which, in the case of undertakings working on well-established lines, may be easily arrived at.

Having fixed a definite figure for the life, the sum which is equivalent to the annual depreciation of the machinery and apparatus may be written off annually and debited to the gross profits, this book entry involving no withdrawal of money from the undertaking; or out of the gross profits, annual investments may be made of such sums as will, at compound interest, reach the amount of the original cost of the machinery and apparatus by the time that they are worn out.

To take an illustration. Let us presume that machinery and apparatus have been acquired at a cost of $500,000, and that twenty-five years has been fixed as the probable life.

If it be decided to invest the depreciation fund in the undertaking, a sum of $20,000 should be debited annually for twenty-five years to "gross profits" and credited to machinery and apparatus, thereby reducing its book value from $500,000 at the start to nil at the end of the twenty-five years.

Or, if it be decided to keep the depreciation fund intact and to invest it in securities yielding, say, three per cent, it will be necessary out of the gross profits to set aside annually the sum of $13,714. Such annual investments bearing compound interest at three per cent per annum will reach $500,000 at the end of the twenty-five years.

Turning to electricity supply undertakings, one finds that their development has been so rapid, and the working conditions have so greatly altered in so short a time, that no standard method has yet been agreed upon for dealing with the question of depreciation, and no definite course has been pursued either by companies or by local authorities.

In the case of undertakings owned by local authorities the issue has indeed been somewhat obscured by the controversial questions which seem inseparable from all municipal undertakings, and by the difference between the financial basis of these undertakings and that of most other industrial concerns.

The object of the present paper is to invite the members of the Institution to consider the question of depreciation in all its bearings as applicable to electricity supply undertakings, in the hope that some definite conclusion may be arrived at as to the proper provision which should be made in the case of undertakings owned, whether by companies or by local authorities.

The word "depreciation" is used in a wide sense, and it is desired to include in the inquiry not only the consideration of the provision which should be made to cover the depreciation in value of the assets of an undertaking, but also as to what other charges beyond the ordinary working costs should be debited to the revenue account before arriving at the net profits of the undertaking.

Following these lines, we have first to consider the question of depreciation proper, then the advisability of creating a reserve fund to provide for unforeseen expenses which may be incurred owing to accident or other emergency, and, lastly, the provision of a further fund to cover antiquation of machinery, apparatus and mains, thereby preparing for the possible necessity of scrapping machinery, etc., which may be in good working order, but which may have become obsolete owing to improvements introduced in methods of generation and distribution.

In the case of undertakings owned by companies, the consideration of these questions resolves itself merely into what should be the amount of the provision to be set aside annually from the gross profits in connection with the above items.

In the case of undertakings owned by local authorities, on the other hand, not only is it necessary to consider the amount to be provided under the three heads of depreciation, extraordinary emergencies and antiquation, but a more controversial point arises, *viz.*, the effect of the peculiar financial basis on which such undertakings rest, upon the necessity for these provisions.

COMPANIES.

Obviously the two classes of undertakings must be considered separately, though in many respects there are points common to both.

Whether the undertakings are owned by companies or by local authorities, the conditions governing their working are such that in order to give a continuous supply of electricity it is essential that machinery, apparatus and mains should be kept in a high state of efficiency.

The cost of so maintaining the plant is, of course, regarded as part of the working costs, and is assumed to be so dealt with. Plant, well maintained as it may be, must, however, gradually depreciate, and a time will come when the frequency and extent of repairs and renewals necessitate so heavy an item of annual expenditure that it is preferable to replace it with entirely new plant.

In order to arrive at the amount with which the gross profits should be debited annually in order to cover this depreciation, it is necessary to settle the number of years which will elapse before the various classes of plant and apparatus in use will arrive at the scrapping stage and will require entire renewal.

At the outset we are confronted with the difficulty that the life of machinery so largely depends upon the way in which it is maintained, that a definite period, at which any particular class of machinery or apparatus would in the ordinary course be entirely worn out, can hardly be taken as of universal application.

On the basis, however, that all plant would be carefully maintained and faulty parts renewed out of revenue, it is suggested that the periods named below represent a fair approximation of the life of the various classes of machinery and apparatus, etc., named:

ESTIMATED YEARS OF LIFE.

	Years.
Land and Buildings	60
Machinery and Plant:	
Boilers	20
Pumps and Pipework	25
Conveyers	10
Engines	25
Turbines	20
Dynamos and Alternators	25
Motors	20
Tools and Sundries	10
Accumulators	15
Transformers, Static	15
Converters, Rotary	20
Switching Apparatus and Instruments	20
Meters	10
Mains:	
Armored	25
Solid System	30
Ducts	30

The "lives" set forth will doubtless provoke some criticism, but it is repeated that the "life" largely depends upon the degree of thoroughness with which the plant is maintained.

With accumulators, for instance, it seems sanguine at first sight to give a life of fifteen years. Further consideration shows, however, that for all practical purposes, with careful upkeep, the life given is merely that of the boxes containing the plates, connections, etc. There is no reason why a battery of accumulators should not last considerably longer than

[1] Paper read before the Institution of Electrical Engineers of Great Britain on April 25.

fifteen years if the plates are regularly renewed out of revenue.

If the above periods be accepted, it becomes a simple calculation as to the amount which must annually be written off or set aside to a sinking fund.

Reference has already been made to the alternative methods of dealing with the depreciation fund. Of those methods doubtless the sounder is that which provides for the annual investment, outside the undertaking, of such sums as will, accumulated at compound interest, represent from time to time the actual aging of the machinery, apparatus, mains, etc.

It is true that if this method were adopted, each extension of the undertaking would necessitate the raising of fresh capital which would have to be subscribed either by the existing shareholders or by the general public. Although this might cause inconvenience, yet, nevertheless, it is urged that by this method a far more definite control would be established over the growth of the undertaking, and the shareholders would have the option of either investing or refraining from investing further capital in it instead of being compelled to do so through the investment of the depreciation fund moneys in it.

It is also urged that should the course advocated be pursued, the company with such an asset at its back would be in a far more favorable position as regards the issue of fresh share capital than it would be if it had invested its depreciation fund in extensions and was compelled to go to the public for more capital, at a time when a large proportion of its machinery and plant had become worn out.

In support of this contention it is pointed out that in many undertakings not only is the existing plant written down in value in the balance sheet, but since the balance so obtained does not exist in cash, it has been considered necessary to form a separate fund, called a renewals fund, which is retained as cash for the purpose of renewing such items as have an exceedingly short life, such as the track in a tramway undertaking.

It seems to be unreasonable that profits should be debited not only with depreciation but also with contributions to a renewals fund. If the depreciation fund existed in readily convertible securities instead of being invested in the undertaking for extensions and the like, it would be available, in the case of a tramway company, to renew the track as soon as the rails were worn out, and the moneys otherwise placed to the renewal fund would have been distributed as profits.

One, of course, gets back to the fact that for the purpose of extensions, fresh issues of capital would be required from time to time, and most directors would doubtless think it preferable to use the money which they had actually in hand before they made an appeal to their shareholders or to the outside public for further share capital. This, indeed, is the method that has almost universally been adopted by the electricity supply companies operating in the metropolis.

So far, the formation of a depreciation fund in the narrow sense of the word has alone been dealt with. The formation of such a fund, apart from the method of accountancy adopted, appears to be essential whether the company is working at a profit or a loss. In the event of its working at a loss for, let us suppose, the first few years, it seems only sound that before any moneys are distributed as dividends, not only should the trading losses be made good, but the contributions to the depreciation fund which otherwise would have been set aside should also be made.

As regards the second item, to which reference has already been made as coming within the purview of the paper, namely, the provision of a general reserve fund, it seems to the author that, however wise the formation of a general reserve fund might be for the purpose of equalization of dividends, it nevertheless does not rank as a strict necessity as does a depreciation fund. Further, he does not agree with those who hold that such a fund is necessary, not only for the equalization of dividends, but for the purpose of providing against extraordinary expenditure due to unforeseen emergencies.

Such emergencies are caused by accident in one form or another, and such risks should be fully insured against and the premiums regarded as part of the ordinary working costs.

Lastly, there is to be considered whether a fund to cover antiquation should be deemed obligatory.

It has been urged on the one hand that no provision whatever need be made under this heading.

Those who hold this view contend that any great revolution in engineering methods which would cause their present plant to become obsolete would necessarily carry with it its own advantages either in the direction of a great improvement in efficiency or in an extension of the uses to which electricity might be put.

They contend that these advantages if really extensive would in themselves more than pay for their adoption, and that unless a company could see its way to larger dividends by adopting an improvement, it would, of course, continue on the old lines.

On the other hand, many hold the view that an antiquation fund is of vital importance, and they point out that a radical improvement might arise which entirely superseded the existing methods of generation and distribution, and while such an improvement would entirely take the field in opposition to the present methods, nevertheless the improvement might not carry with itself a sufficient margin of profit to cope with the dead weight of interest on capital expended upon superseded plant.

A company which was without an antiquation fund would then be faced by the possible competition of a new concern not so overburdened with capital charges, which could completely relieve them of their business.

The author does not share the latter view to the full extent, but, on the other hand, he thinks that no electricity supply undertaking can be regarded as in a thoroughly sound position unless some provision has been made in the direction of an antiquation fund. At the same time this provision is, in his provision, not one which would rank on the same footing as a depreciation fund *per se*, but is one which might wisely be contributed to out of profits as a sort of nest-egg for the future.

The distinction which he desires to draw between the contributions to a depreciation fund and contributions to an antiquation fund is practically that the former should be built up whether the undertaking is working at a loss or not, while contributions to the latter fund need only be regarded as advisable when a concern is in a flourishing condition.

LOCAL AUTHORITIES.

In considering the case of local authorities owning electricity supply undertakings, it is seen that their method of raising the capital precludes them from adopting the plan in vogue among the companies of writing down the value of their machinery, apparatus, etc., and keeping the money in the business.

Members of the Institution are, of course, aware that the capital expenditure required in connection with undertakings owned by local authorities is raised in the United Kingdom by means of loans upon the security of the general district rate, such loans having to be repaid at certain definite periods. These repayments are secured by the creation of sinking funds, the annual payments to the sinking funds being provided out of the revenue of the

undertaking, and deficit which may arise being met by a charge upon the rates.

In the case of loans authorized by the local government board the practice hitherto has been to allow a period of twenty-five years for the repayment of loans required for electricity supply undertakings.

The period of twenty-five years is supposed to represent the average life of the various sets of machinery, apparatus, and of the mains, buildings, etc., upon which the capital expenditure is to be incurred. That is to say, that while the life of such items as lands, buildings, etc., is well over twenty-five years, on the other hand expenditure is incurred upon pieces of apparatus whose life is considerably less than twenty-five years.

While perhaps it does not bear strictly upon the subject-matter of this paper, reference may be made, in connection with the life of various portions of the plant, to the system by which one may arrive at an equated period for a loan which covers the purchase of various apparatus and machinery, with varying "lives."

The method of arriving at the equated period, in common vogue, is to take the average of the lives, taking into consideration, of course, the different monetary values.

As a matter of fact, this method can only give a more or less correct approximation of the true equated period. When the rate of interest payable on the sinking fund is a comparatively low one, and the various periods are not greatly dissimilar, the result obtained by averaging the lives does not differ widely from the result obtained by calculating the true equated period. On the other hand, under other conditions which are quite likely to obtain in practice, the divergence may be considerable.

Perhaps it should be explained what the author means by the use of the words "the true equated period."

In dealing with a number of loans for various periods of years, two courses are open to the borrower. He may either deal separately with each separate loan and pay each off as it becomes due, or he may arrange with the lenders to equate the whole of the loans, and thus enable him to erect one sinking fund, and to pay off the whole amount of his indebtedness at one time.

From both the point of view of the borrower and the lender, it is, of course, an axiom that whichever of these two courses be adopted, neither party shall be the loser from a financial point of view. In other words, the arrangement must be such that the present value to the lender of the combined loan, repaid at the equated period, must be exactly the same as the present value to the lender of all the separate loans.

In arriving, therefore, at the true equated period of a number of loans, it is not sufficient to take the mean value of the lives of the assets and thus to ignore the compound interest question. The exact method is to arrive by calculation at a period of years such that, if the total amount of the various loans were repayable at the end of that period, the present value of that loan would be equal to the present value of all the separate loans repaid at their various individual periods.

As stated above, the difference between the results arrived at by these two methods is not great when the rate of interest at which the sinking fund is invested is about three per cent and when the different periods are not greatly dissimilar. When, however, the periods to be equated differ widely, or when the rate of interest is a higher one, considerable difference appears, as may be shown by the following example:

Let the loans set out below be obtained and be repayable at the expiration of periods named:

$100,000 repayable in 60 years
150,000 repayable in 25 years
50,000 repayable in 15 years
50,000 repayable in 10 years

The average of the above periods is 31.43 years, arrived at as follows:

100,000	× 60 =	6,000,000
150,000	× 25 =	3,750,000
50,000	× 15 =	750,000
50,000	× 10 =	500,000
350,000		11,000,000

$$\frac{11,000,000}{350,000} = 31.43.$$

The present value of $100,000 due 60 years hence at three per cent is $16,970.00
The present value of 150,000 due 25 years hence at three per cent is 71,641.50
The present value of 50,000 due 15 years hence at three per cent is 32,093.00
The present value of 50,000 due 10 years hence at three per cent is 37,204.50

Total of loans, $350,000 — Total of present values, $157,912.00

To obtain the required equated period it is only necessary to calculate the number of years (n) at which $350,000 would be due in order to have a present value of $157,912:

$$\frac{350,000}{1.03^n} = 157,912$$

$$n = \frac{\log 350,000 - \log 157,912}{\log 1.03}$$

$$n = 26.92.$$

In the past it has often been contended that in the case of local authorities no further provision for depreciation beyond the sinking fund payments is necessary in arriving at the true annual profits, owing to the fact that the annual contributions to sinking fund are such that by the time the plant has been worn out, the indebtedness in respect of the capital expenditure on same will have been extinguished.

The opponents of municipal trading have not only strongly contested this view, but the discussion has been further complicated by attacks on the period of twenty-five years, arrived at by the equation of the lives of the various portions of the plant.

Apart, however, from the soundness of the basis taken in arriving at the equated period for repayment of loans, the opponents of municipal trading have contended that not only should annual contributions to the sinking funds be made of such amounts as will be sufficient to extinguish the indebtedness at the end of the loan periods, but that further contributions should be made either from revenue or from the rate fund of such amounts as would provide a fund sufficient entirely to renew the machinery, apparatus, mains, etc., without incurring fresh indebtedness when the original "outfit" is worn out. That is to say, it is sought to burden the undertakings of local authorities not only with the instalments by which their indebtedness is extinguished, but with further contributions in the form of "provisions for depreciation" equal in amount to what would be set aside for that purpose in the case of undertakings belonging to companies, in spite of the fact that in the latter case no provision for the repayment of the original capital is made.

The principle hardly seems sound.

Assuming for the moment that the equated period in the case of the loans for electricity supply purposes were exactly correct, and that it truly represented the life of the plant, the undertaking at the end of the equated period would be free from debt by the operation of the sinking fund, and would be then in just as good a position from the ratepayers' point of view as it was when the undertaking was first begun.

A local authority's undertaking may be likened to one owned by a statutory company consisting of seven original shareholders who put up the sum necessary to obtain their Parliamentary powers, and who, having obtained these powers, raised the whole of the capital necessary to carry out the undertaking in the form of debentures repayable at the end of twenty-five years, the interest and repayment in

respect of the same being personally guaranteed by the original shareholders.

The seven shareholders in such a company would be in very much the same position as the ratepayers in the case of a local authority's undertaking. Any losses in working would fall upon their shoulders, and any profits which remained after paying the debenture interest and after setting aside contributions to a sinking fund for the repayment of the debentures would go into their pockets.

In the case of such a company it would hardly occur to the seven shareholders, in addition to their sinking fund instalments, to put aside what profit they might make to a reserve fund until it had amounted to the full amount of the capital which had been lent them by the debenture holders.

So long as the shareholders maintained their undertaking in working order and in the position to earn them dividends till the end of its life, they would be content to leave the future to take care of itself, though it is probable that the shareholders, being personally liable for any losses, would take the precaution of providing a reserve fund as an insurance against losses which might be incurred in future working.

The shareholders would surely not deem it incumbent upon them to set aside from their profits a sum sufficient to enable them to continue their undertaking when their plant was worn out, without raising further capital by means of debentures. If their undertaking had been a success, and if their credit were not impaired, there would be no reason why they should not borrow the further capital necessary to replace their worn-out plant and so be enabled to continue the undertaking on the former lines.

If this point be conceded the whole question as to the proper provision for the future in the case of local authorities resolves itself into a determination of what the amount of the reserve fund set aside by our seven shareholders should be.

The question may be asked: Why is it necessary to consider undertakings owned by local authorities on a different basis from those owned by companies? If the sinking fund payments be regarded as part of the contributions to the depreciation and reserve funds, the two classes of undertaking might surely be considered together.

The question, however, does not present so simple an issue as this, since, in the case of local authorities, the period for the repayment of loans is an equated one, and does not actually represent the period of time during which the whole of the "plant" used in the undertaking will continue in proper working order, though efficiently maintained.

Certain portions of the plant have shorter lives than others, and when they are worn out it is necessary to incur further capital expenditure in order to replace them.

As, however, the sinking fund remains intact until the end of the equated period of twenty-five years, no portion of it is available for the renewal of the short-lived portions of the plant when they are worn out.

We have carefully to consider what effect these circumstances have on the building up of the depreciation fund: should it make provision for the renewals of the short-lived portions of the plant in order to avoid the necessity for incurring fresh indebtedness before the original loans had been repaid?

In this connection it must be borne in mind that although this difficulty arises in the earlier years under the system by which an equated period is given for repayment of all the capital expenditure, nevertheless, a corresponding advantage is gained in the later years of the undertaking subsequent to the expiration of the equated period. The life of certain of the assets is considerably greater than the equated period of twenty-five years, so that after the expiration of the twenty-five years the total capital expenditure on this class of expenditure has been entirely wiped off, while no necessity arises for further capital expenditure in this direction till a later period.

In the hands of a company the sinking fund provided out of profits would without doubt be drawn upon for the purpose of renewing any portion of the machinery and plant that may have worn out; but this is not possible in the case of a local authority, whose sinking fund is earmarked for the purpose of the liquidation of a special loan.

If any particular portion of the plant had only a life of ten years, and was provided for by a ten years' loan, it is obvious that at the expiry of the ten years and the wiping off of the original loan an amount could be re-borrowed to provide the new plant. The tendency of the local government board is to divide up the loans into periods of life, and when this is done universally all will be plain sailing. In the meantime the difficulty arises in the case of all loans for equated periods.

It must be remembered that the annual contribution to the sinking fund in the case of equated loans covers the depreciated life of both short and long-lived assets, and in my opinion a local authority should be permitted to re-borrow for the replacement of worn-out machinery, apparatus, etc., provided that such re-borrowings shall from time to time never exceed the amount contributed to the sinking fund, and provided that the term of the new loan should coincide with the "life" of the new plant. If this were permitted a local authority would be placed in the same position as a company in respect of its depreciation fund.

The author's final contention, then, is that a local authority should treat depreciation exactly as a company treats it.

It should set aside annually such sums as, properly invested, will enable it to wipe off the value of the machinery and plant at the end of its life. If the loan in respect of such machinery and plant is for a period similar to that of their life, then no further sum need be set aside annually.

If, however, the loan, as in the case of some local authorities in the metropolis, be for a period of forty-two years, whereas the equated life of the plant was agreed to be twenty-five years, then the annual instalments should be of such amount as would produce the capital sum in twenty-five years. The actual contributions to the forty-two-year sinking fund would be treated as part payments, and it would be necessary to set aside a further sum annually to bring the contributions up to a twenty-five years' basis.

To carry this illustration further it may be noted that to liquidate a loan of, say, $500,000 in twenty-five years requires an annual instalment of $13,714 (presuming an investment of three per cent), whereas only $6,096 would be required if the loan were spread over forty-two years.

RESIDUAL VALUES.

To arrive at an absolutely accurate amount of annual contribution to a depreciation fund it would be necessary to determine the residual value of the machinery, apparatus, etc., at the end of their respective lives. In the case of land it, of course, remains, and the scrap value of machinery, apparatus, mains, etc., containing a fair amount of copper and other metals, is appreciable. As, however, a depreciation fund must in its nature be based upon an estimate, it has seemed to the author wise to regard the residual value as an item which the undertaking would have to the good at the end of the respective lives, and one which to that extent would be in hand as a contribution toward the cost of new plant.

Electric Trains Under the Detroit River.

A tunnel is being built under the Detroit river for the transference of both freight and passenger trains between the United States and Canada on the Michigan Central Railroad. The tunnel will replace the present ferry service between Detroit on the American shore and Windsor on the Canadian side of the river. Two tracks will be laid in separate iron tubes sixty-five feet beneath the surface of the river. These iron tubes will rest on beds of concrete and will be flanked by concrete walls. The electrified zone will be 4.6 miles in length and will comprise with the yards some fifteen miles of single track.

As might be surmised, electricity will be used as a motive power; the electric locomotives not only permitting greater celerity in handling traffic, but also affording a complete solution of the ventilation problem. Six 100-ton direct-current locomotives of the swivel-truck type, with geared motors, will comprise the initial equipment for hauling both freight and passenger trains. Each locomotive will be capable of hauling a 900-ton train up a two per cent grade at a speed of ten miles per hour. Four 280-horse-power motors will be mounted on each locomotive, two motors being placed on each of the two swivel trucks. The Sprague-General Electric multiple-unit control system will be furnished, enabling the locomotives to be operated singly or in train. Current for operating the motors will be taken from the third rail by means of contact shoes. Automatic, high-speed air-brakes will form a necessary part of the equipment. The electrical equipment for the locomotives as well as for the tunnel, in general, will be furnished by the General Electric Company.

Power for operating the system will be purchased from the Detroit Edison Company and will be delivered to a substation at Detroit at a potential of 4,400 volts, and at a frequency of sixty cycles. At the substation two 1,000-kilowatt synchronous motor-generator sets will be installed for supplying direct current to the third rail. Each of these sets will consist of a 1,000-kilowatt, 4,400-volt, three-phase, synchronous motor, direct connected on a common base to a 1,000-kilowatt, 650-volt, compound-wound, direct-current generator. A fifteen-kilowatt, 125-volt exciter for the synchronous motor will be mounted on a shaft extension of each of the motor-generator sets.

A very complete electric lighting and electric pumping equipment forms a part of the project. The yards and approaches to the tunnel will be lighted by arc lamps, while the tunnel itself will be illuminated by incandescent lamps arranged on duplicate circuits. Alternating current from the main power supply at a frequency of sixty cycles will be used on the lighting circuits. To insure an uninterrupted lighting service the lighting circuits in the tunnels are so arranged that half the lamps in both tunnels will burn if, by chance, either of the lighting circuits in the tunnels should be broken. A single three-phase distributing circuit will run through each tunnel and from these circuits suitable connections will be made to step-down transformers. The secondaries of the step-down transformers will be interconnected with duplicate circuits for half the lamps in each of the tunnels.

No less interesting will be the equipment for keeping the tunnel dry. Five sumps will be provided in the tunnel, each sump drained by induction-motor centrifugal pumps arranged in duplicate. The motors on the pumps will operate directly on 4,400 volts and the controlling circuits with compensators will be centralized in the substation. For indicating the amount of water in each sump, a float system will be provided having both visible and audible indicating devices in the substation.

At the substation a regulating storage battery will be provided to carry the fluctuations of the load. If the main power supply from the Detroit Edison mains should be interrupted this storage battery will have sufficient capacity to operate the entire system for half an hour. In such an emergency, the lighting and pumping alternating-current equipment will be energized by sixty-cycle, alternating current from a fifty-kilowatt motor-generator set, the driving motor being supplied with current from the storage battery. Flexible switching arrangements will be installed to enable this interchange of power supply to be easily and quickly made.

Edwards Electric Headlight Company Sold.

Edward J. Widdell, receiver for the Edwards Electric Headlight Company, Chicago, Ill., under direction of Judge Richter, of the Laporte, Ind., Circuit Court, has sold at receiver's sale the plant and patents of the company to W. I. Phillips and McDowell, Stocker & Company, of Chicago, and the Schroeder Headlight Company, of Evansville, Ind. The Edwards company manufactured electric headlights and gasolene engines. The sale, it is understood, was for $8,800.

Progress of Construction of the Milwaukee Northern Railway.

Such progress has been made during the fall and winter months on the construction work of the Milwaukee Northern Railway, which will open up communication between the eastern Wisconsin towns of Sheboygan, Port Washington, Fon du Lac, West Bend and numerous others in this populous district and Milwaukee, that it will probably be ready for operation on at least one division by early summer.

The district thus thrown open is extensive, rich and populous; but up to the present time has been practically isolated from the Wisconsin metropolis because of the transportation facilities. Milwaukee merchants will be placed in touch with 100,000 people, through its agency; and constant and rapid communication will be established between Milwaukee and Thiensville, Cedarburg, Grafton, Port Washington, Cedar Grove, Sheboygan on the Sheboygan division, and West Bend, Barton, Kewaskum, Campbellsport and Fond du Lac on the Fon du Lac division. The Milwaukee Northern will bring into intimate touch with Milwaukee the county seats of four counties; two of which have a population of about twenty-five thousand each.

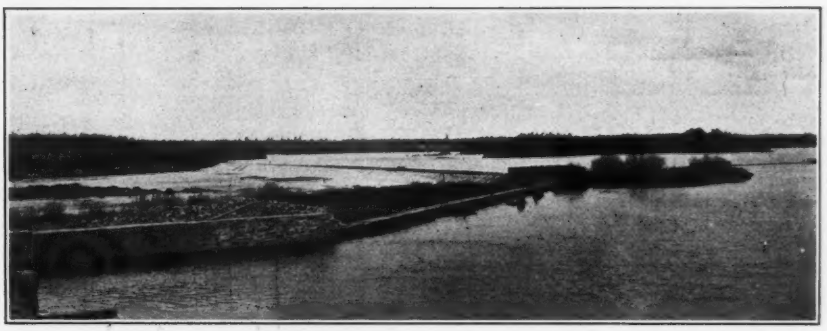
The entire scheme of the Milwaukee Northern right of way was planned to secure high speed operation from one end to the other. This fact is apparent not alone from the straight right of way, and absence of grade crossings, but also from the high class generating equipment in main power stations and substations along the line, and a noteworthy fact in this connection is that the entire equipment of whatever kind was all purchased or will be built in Milwaukee and along the right of way. The Milwaukee Northern is a "home-made" product.

The complete power equipment was purchased from and built by the Allis-Chalmers Company, of Milwaukee, and is of standard Allis-Chalmers design, both for gas engines and alternators. The electrical features of the equipment may be briefly described as follows: three-phase, alternating current will be generated in the power-house at 405 volts by three direct-connected alternators each of 1,000 kilowatts normal capacity, driven at 107 revolutions per minute by Allis-Chalmers twin tandem gas engines, each with a rated capacity of 1,500 horse-power.

The main power-house is located at Port Washington, and sites for substations have been provided at the following points: Burleigh, Cedarburg, Georgia avenue, Marblehead, Brown Deer, Cedar Grove, West Bend and Campbellsport.

Electrical Equipment of the Grand Rapids Pulp and Paper Company, Grand Rapids, Wis.

THE power requirements of pulp and paper mills present many problems arising from conditions peculiar to this class of industries. Continuity of service and uniform speed are essential to the successful manufacture of paper, as when a run is started it must be continuous, and any lack of uniformity in speed seriously affects the quality of the product. The starting conditions of some of the machinery are severe and a large overload capacity in the motive power is therefore necessary.



VIEW OF WISCONSIN RIVER, SHOWING DAM OF THE GRAND RAPIDS PULP AND PAPER COMPANY, GRAND RAPIDS, WIS.

Electric motors have been found to fulfil all these requirements and have been adopted to a large extent by pulp and paper manufacturers. Many advantages are derived from their use that to a large extent eliminate the objectionable features of mechanical transmission. A flexibility is gained which permits the subdivision of units to such an extent that power may be delivered directly at the various points of application, thus eliminating the use of long lines of shafting and belting with their many attendant disadvantages and the control of each section or individual machine is placed directly in the hands of the operative. Another important feature is that portions of paper machines operate at variable speeds. These portions, which include the wire,

GRAND RAPIDS PULP AND PAPER COMPANY. 1.—TEN-HORSE-POWER MOTOR OPERATING CUTTER ROOM AND ELEVATOR. 2.—FIFTY-HORSE-POWER MOTOR OPERATING CONSTANT SPEED OF EIGHTY-SIX-INCH PAPER MACHINE. 3.—ARRANGEMENT OF SHAFTING FOR VARIABLE SPEED DRIVE OF PAPER MACHINE. 4.—BACK VIEW OF PAPER MACHINE, SHOWING METHOD OF DRIVING FROM BENEATH THE FLOOR.

press rolls, dryers and machine rollers. It is essential that the speed variations cover a considerable range, be easily controlled and complexity avoided as far as possible. In existing direct-current plants or mills where it is deemed advisable to install direct-current motors the variable-speed feature is taken care of by the use of variable-speed motors, regulated by field control, which have a sufficient range to entirely eliminate the use of mechanical speed-changing devices which are necessary where mechanical transmission of power is used. This greatly simplifies the system and prevents the loss of power in overcoming the friction of belts and moving parts. The variable-speed motor is easily controlled and has a definite known speed for each notch of the controller, which gives the operator an intelligent conception of the speed of his machine at all times. This is in great contrast to mechanical speed-changing devices which require considerable manipulation to operate without any definite knowledge of intermediate speeds.

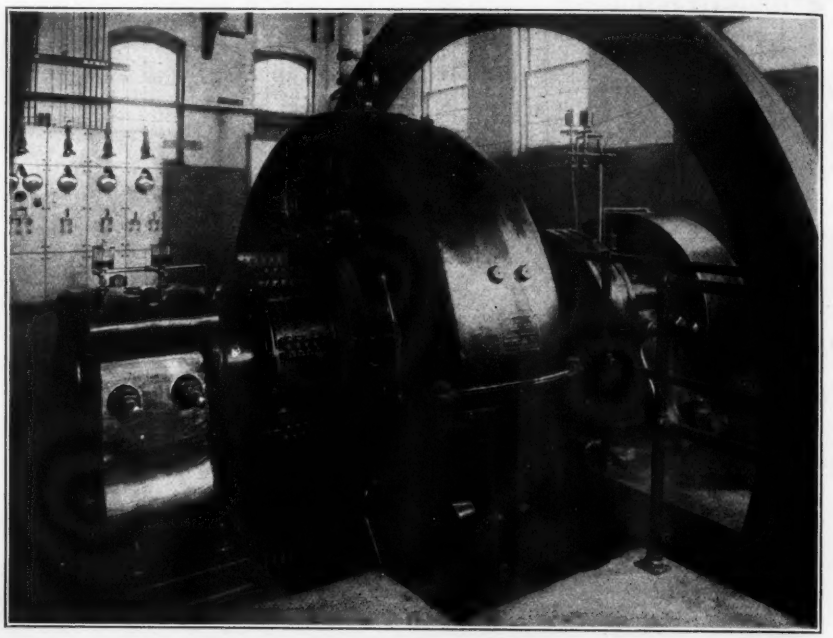
An illustration of the foregoing remarks is found in the plant of the Grand Rapids Pulp and Paper Company at Grand Rapids, Wis. The mills are located on the Wisconsin River, about four miles from the town, where an abundance of water power is available. This company strongly advocates the use of electric drive and fully realizes the many advantages derived from its use. The electrical equipment was laid out by V. D. Simons, general manager of the company, and installed under his direct supervision. There are many mechanical and electrical features of interest, and the entire installation is an example of modern engineering practice.

The pulp mill, where the stock is prepared for the manufacture of paper, is operated by water power, but the various processes afterward carried on employ electric drive.

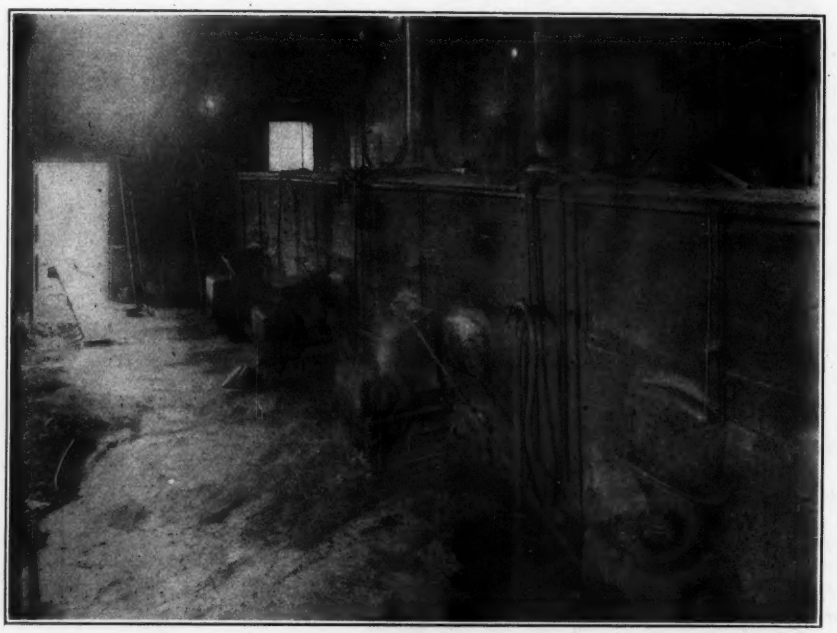
One of the essential conditions of paper making is that as the weight or thickness changes, the speed must be easily altered to provide for changes in the rate of production, which is usually accomplished by mechanical means. In the present case, however, the engineer accomplishes this result by the use of variable-speed motors.

There are two Beloit paper machines, the smaller of the two having a capacity of 525 feet per minute, or a total of twenty-one tons per day, the width of the paper being eighty-four inches before and seventy-eight inches after trimming. There are twenty-nine dryers and a seventy-foot wire. That portion of the machine which operates at variable speeds is driven by a 100-horse-power Westinghouse variable-speed, shunt-wound motor with a speed variation of 470 to 750 revolutions per minute, which is obtained by field control. The actual power required, as shown by tests, to drive the variable-speed portion of the machine under normal working conditions, *i. e.*, 525 feet per minute, is 101 horse-power. That portion of the machine which operates at constant speed is driven by a fifty-horse-power Westinghouse type S motor.

The larger machine has a capacity of twenty-six tons of paper per day at the rate of 475 feet per minute, 104 inches wide before and ninety-seven inches after trimming, and is provided with twenty-five dryers and a sixty-foot wire. The variable speed portion is driven by a 100-horse-power Westinghouse direct-current shunt-wound motor with a speed variation ranging from 470 to 750 revolutions per minute, obtained by field control. Actual power determined by tests to drive the variable speed is ninety-seven horse-power.



200-Kilowatt, 220 Volt Direct-Current Generator, Grand Rapids Pulp and Paper Company, Grand Rapids, Wis.



Boiler Room, Grand Rapids Pulp and Paper Company, Grand Rapids, Wis.

The constant speed portion is driven by a fifty-horse-power Westinghouse type S motor. The use of shunt-wound motors permits the use of field control, which has the advantage of high efficiency and good regulation throughout its range.

In the cutter room there are two cutters and an elevator operated by a ten-horse-power Westinghouse type S back-geared motor. An interesting feature in connection with this motor is that it replaced 250 feet of three and seven-sixteenths-inch line shaft.

A ten-horse-power Westinghouse motor driving a fully equipped machine shop for general repair work completes the electrical equipment.

The present daily average output of this company is forty-five tons of newspaper.

SWITCHBOARD, GRAND RAPIDS PULP AND PAPER COMPANY, GRAND RAPIDS, WIS.

The boiler plant consists of four return-tube units, seventy-two inches by sixteen inches, equipped with American underfeed stokers. The furnaces are the Dutch oven type arranged for burning refuse wood and screening coal. A fifty-four-inch Buffalo Forge Company's fan operated by a Westinghouse ten-horse-power type S variable-speed motor furnishes forced draft.

The generator equipment consists of one Westinghouse 200-kilowatt, 220-volt, engine-type, direct-current generator, direct connected to a twenty-two-inch by thirty-six-inch Corliss engine operating at 125 revolutions per minute, and one Westinghouse 150-kilowatt generator of the same characteristic belted through a countershaft to a water-wheel. The rated speed of the generator is 600 revolutions per minute, and it operates in parallel with the engine-driven machine.

An interesting feature in the regulation of the water-wheel is the arrangement for controlling the gates. They are operated by a Westinghouse series-wound reversible back-geared motor, started, stopped and reversed by means of a double push-button on the switchboard. There is also an attachment on the governor of the engine for automatically controlling the motor, thus regulating the respective loads of the two generators.

The switchboard is of standard Westinghouse construction and consists of two generator and three feeder panels.

Electricity in Spain.

Consul-General B. H. Ridgely, of Barcelona, Spain, writes that according to a recently published report there are 1,140 generating stations in Spain, with a total capacity of 99,513,170 kilowatts. The consul-general continues:

Madrid produces the greatest quantity of electricity, 15,998 kilowatts. Barcelona follows with 8,082 kilowatts. The total number of incandescent lamps in Spain for street lighting is 119,105, with 1,427,498 candle-power, and 1,691 arc lamps of 1,214,476 candle-power. For private or domestic use there are 1,593,402 incandescent lamps of 13,333,783 candle-power and 8,051 arc lamps of 5,303,777 candle-power. There are also 3,293 electric motors with a total capacity of 25,382 horse-power.

The importation of incandescent lamps and globes and electric-light fixtures into Spain has reached considerable proportions and is growing steadily. Statistics for 1906 are not yet available, but in 1905 incandescent burners mounted and unmounted were imported to the value of $90,000, of which $50,000 worth came from Germany and $27,000 from France. In spite of the fact that several small factories are now manufacturing these goods in Spain, imports in 1906 are presumed to have increased at least 25 per cent.

Arc lights, electric-light meters, current-cutters, and other similar electric light appliances were imported to the amount of $302,000, as follows: From Germany, $189,856; France, $83,145; Austria, $10,067; Switzerland, $5,985; the United States, $5,429, and other countries, $7,518.

The Spanish customs duty on incandescent burners mounted is $1.93 per two and one-fifth pounds; unmounted, $2.89. The duty on arc lights, electric-light meters, current-cutters, etc., is forty-eight cents per two and one-fifth pounds.

Conviction for Selling Stolen Electrical Appliances.

The manufacturing and jobbing trade will be interested to learn of the success that has attended the prosecutions of Ralph Lipsey, formerly president of the Great Northern Metal Company, and a second-hand dealer in Chicago, Ill., whose conviction for receiving stolen property has just been affirmed by the Supreme Court of Illinois; and also of the plea of guilty made by Arthur Dietrickstein, held under a charge of larceny, and of his imprisonment on the plea. These two conspired together and succeeded in stealing several cases of electrical sockets from one of the large Chicago jobbers. Dietrickstein stole the goods and sold them to Lipsey. The cases against both Lipsey and Dietrickstein were worked up by Frederic P. Vose, counsel for the National Electrical Trades Association, and attorney for many of the electrical manufacturers and jobbers. The prosecution was handled by Assistant State Attorney James J. Barbour, whose work in the trial of the cases resulted in conviction. The conviction of these two men eliminates one of the most offensive menaces to legitimate trade in Chicago.

Annual Meeting of the American Institute of Electrical Engineers.

The annual meeting of the American Institute of Electrical Engineers was held in the auditorium of the Engineering Societies Building, New York city, Tuesday evening, May 21. The report of the secretary showed 4,521 members enrolled, disbursements of $52,538.94, and an excess of receipts over disbursements of $2,645.90.

The board of tellers reported that out of 2,470 valid ballots cast, 2,358 were in favor and 95 against the new constitution, which consequently goes into effect on June 10.

The board of tellers reported the following election of officers:

President, Henry Gordon Stott; vice-presidents (for a term of three years), L. A. Ferguson, J. G. White, W. C. L. Eglin; managers (for a term of three years), B. G. Lamme, H. W. Buck, P. H. Thomas, Morgan Brooks; treasurer, G. A. Hamilton; secretary, Ralph W. Pope.

The paper of the evening, "Some Facts and Problems Bearing on Electric Trunk Line Operations," was presented by Frank J. Sprague.

Electricity in Turkey.

Consul Ernest L. Harris, of Smyrna, states that several concessions have been granted recently by the Sultan of Turkey for electrical undertakings. Turkey is practically a virgin soil for electrical enterprise. Up to a year ago there was not a single city or town in the 80,000 square miles of Turkish possessions which could boast of a telephone system or a central station for electric light and power.

Notice of Purchases, Navy Department, Bureau of Supplies and Accounts.

Bids will be opened in Washington, D. C., May 21, May 28 and June 11, for the following material:

Article.	Quantity.	Delivery at Navy Yard.	Sched.
Armatures for motors	8	Wash., D. C.	775
Battery for electric launch (92 cells)	1	Norfolk, Va.	782
Cabinets, rammer, c. b.	1	....do	775
Controllers, rammer	4	....do	775
Current, electric	27,600 k.w.-hrs.	Key West, Fla.	759
Do	1,058,400 k.w.-hrs.	Mare Is., Cal.	704
Fixtures, electrical	Miscellan'us	Pensacola, Fla.	759
Irons, electric soldering	26	League Is., Pa.	788
Machine, magnet winding	1	Mare Is., Cal.	706
Motors	2	....do	706
Motors-drive outfit	1	....do	706
Motor induction	1	Boston, Mass.	782
Tape, cotton, insulation	1,300	New York	796
Wire	8,000 feet	Pensacola, Fla.	759

Bids will be opened May 28 and June 4 for the following material:

Article.	Quantity.	Delivery at Navy Yard.	Sched.
Cable, copper	5,500 feet	Ports., N. H.	801
Carbons	3,000	Annapolis, Md.	805
Lamps, incandescent	8,000	....do.	805
Wire	7,000 feet	Boston, Mass.	812
Wire, copper	51,000 feet	Ports., N. H.	801

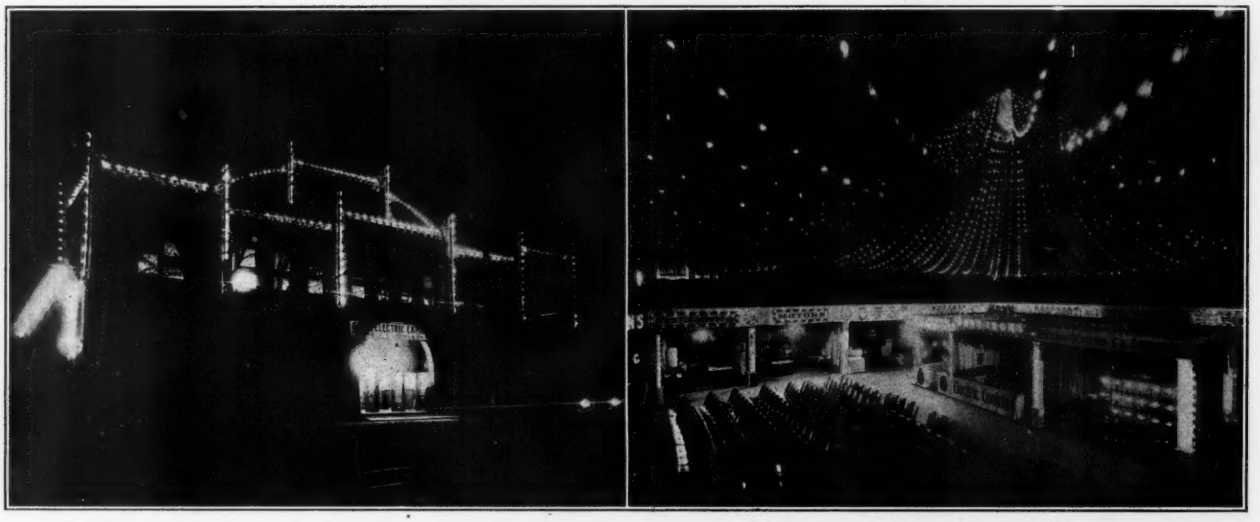
Bids will be opened May 28, June 4 and June 11 for the following material:

Article.	Quantity.	Delivery at Navy Yard.	Sched.
Copper conductor and lamp cord	13,000 feet	Pensacola, Fla.	840
Fixtures, etc., electrical	Miscellan'us	....do	838
Do	....do	....do	840
Generator, turbine	1	Newport, R. I.	814
Lamps, incandescent	1,000	Pensacola, Fla.	838
Motor, 15 H. P.	1	New Or., La.	841
Motor and gear	2	Ports., N. H.	850
Wire, miscellaneous	300 lbs	Pensacola, Fla.	840

The first annual convention of the Illuminating Engineering Society will be held at Boston, Mass., week of July 28. Details will be published as announced.

The Electrical Show of the Lincoln Gas and Electric Company.

The Lincoln Gas and Electric Company, Lincoln, Neb., during the week of April 22-27, held a most successful and elaborate electrical exhibition at the Lincoln Auditorium. The idea of the exhibition, which was under the direction of Homer Honeywell, manager, and Theodore V. Mitchell, manager of the new-business department, was to educate the people to an understanding of the great possibilities in the use of electricity and gas. No admission was charged, and everything was done to make the affair of the greatest possible interest to the visitors. The illustrations shown herewith give an indication of the elaborate way in which many of the booths and the auditorium were illuminated and decorated. The interior of the building was festooned with over 4,000 incandescent lamps, and over a thousand incandescent lamps were used for outlining the exterior of the building.



THE EXTERIOR AND INTERIOR ELECTRICAL DECORATIONS OF THE LINCOLN AUDITORIUM ON THE OCCASION OF THE ELECTRICAL SHOW OF THE LINCOLN GAS AND ELECTRIC COMPANY, LINCOLN, NEB.

Mrs. E. O. Hiller gave a demonstration every afternoon and evening, and showed, in a practical way, the facilities and advantages which the housekeeper could secure through the use of electrical and gas cooking and heating appliances.

Among the companies exhibiting apparatus were the Westinghouse Electric and Manufacturing Company, represented by W. R. Pinckard, S. G. Peticolas and W. G. Williamson. This company's exhibit of motor-driven sewing machines, washing machines, coffee mills, mangles, water-level float systems and measuring instruments attracted a great deal of attention.

The Haller Machine Company, Chicago, Ill., showed a number of made-up signs and sign units.

The W. J. Barr Electric Manufacturing Company, Cleveland, Ohio, made a very interesting display of flat-irons, coffee percolators, electric heaters, heating pads and other utensils. The company was very ably represented by W. J. Barr.

The Wagner Electric Manufacturing Company, St. Louis, Mo., exhibited motors and measuring apparatus.

R. Williamson & Company, Chicago, Ill., exhibited a number of handsome chandeliers of modern design.

Lincoln Gas and Electric Company displayed a number of labor-saving appliances in its industrial exhibit, and also showed mercury arc rectifiers, flashing signs and numerous electrical novelties and special devices.

On Friday evening, after the show, the exhibitors were the guests of the company at a banquet held at the Lindell Hotel. Mrs. Hiller was toastmistress.

Triple Motor-Generators.

An interesting balancer has been installed in the power station of the Blankenese-Ohlsdorf line of the Hamburg (Germany) Metropolitan and Suburban Railway. It is described briefly in the *Electrical Review* (London), May 3, by Alfred Gradenwitz. The machine is designed for generating single-phase alternating current of twenty-five cycles for operating the railway, an alternating current of fifty cycles for lighting, and direct current for exciting the alternators and charging the exciting battery. It is connected as a balancer across the three circuits, so that at times it draws power from the twenty-five-cycle circuit, the fifty-cycle machine running as a generator; and at other times operates in the reverse sense. The machine may also be driven by the direct-current generator running as a motor and drawing its supply from the batteries; but is generally used in this way only for starting purposes. The rotors of the three machines are mounted on the same shaft, the two revolving fields being placed side by side between a single pair of bearings, the direct-current armature being at the other end of the shaft between the central bearing and a second outboard bearing. The two alternators are each rated at 600 kilowatts, 6,300 volts, when operating as generators. The direct-current machine is rated at 250 kilowatts, 220 volts. There is a smaller machine of the same kind, in which the twenty-five-cycle section is rated at 250 kilowatts, and the fifty-cycle part at 150 kilowatts.

Some of the Booths at the Electrical Show of the Lincoln Gas and Electric Company, Lincoln, Neb.

The Bryan-Marsh Company, Chicago, Ill., exhibited tantalum and metallized-filament lamps, and attracted a great deal of attention. The company was represented by E. H. Haughton and F. M. Henkel.

Among the local companies exhibiting were the Nebraska Telephone Company, the Lincoln Sign Works Company, and the Lincoln Telephone Company. The

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Electrical Method of Extracting Soot from Air in Flues.

Two years ago it was noticed by George W. Walker that a body positively electrified to 100 volts became covered with soot in a day, while a negatively charged body remained comparatively clean. This effect has recently been applied to cleaning air by inserting in an air flue a sheet of wire gauze connected to the positive of a 250-volt supply. Electrified wire gauze is very efficient in extracting soot from the air, and the method proves a simple means of cleaning air supplied to large buildings in towns where there is much smoke.—*Abstracted from Nature (London), April 25.*

Statistics of the Central Electric Stations of the Netherlands.

A statistical table is given here showing the number of central stations, and the output and size of the equipment, in the Netherlands. There are altogether thirty-two stations at various cities. The largest of these is the municipal plant at Amsterdam, which has a total output of 6,200 kilowatts. The next largest is the Electra station in the same city, with a rating of 2,460 kilowatts. The third station in size is the municipal plant at Rotterdam, rated at 2,048 kilowatts. The other stations are all comparatively small, the largest being a Siemens & Halske plant at La Haye, rated at 700 kilowatts. The total of all the thirty-two stations is only 15,145 kilowatts. The output of these stations is largely for lighting. The large Amsterdam station has about 61,000 fifty-watt incandescent lamps connected to its system, and about 925 arc lamps, and about 2,600 horse-power in motors. The other Amsterdam station has 57,000 incandescent lamps connected, and 460 horse-power in motors. The Rotterdam station has 38,000 incandescent lamps, 1,031 arc lamps, and 4,600 horse-power in motors. The charges for this power vary considerably both for lighting and power. At Amsterdam the cost varies from five to six cents per kilowatt-hour for lighting, and from three and one-half to six cents for power. At Rotterdam the charges vary from nine to sixteen cents for lighting, and from five to ten cents for power.—*Translated and abstracted from Electro (Brussels), April.*

Solid Dielectrics.

An interesting discussion of research conducted by L. Malclès in the subject of dielectric constants is given here. The object sought was to study that effect to which is due the extra or residual charge of condensers. A careful study of commercial paraffine fusible at seventy-two degrees centigrade showed that it presents a perfect stability and does not give rise to any such extra charge. This material may then be used as a standard for comparing others. The method employed consisted in coupling two condensers in opposition, the two being connected to an electrometer. They were then charged to the same potential, and after standing for some time were discharged one into the other. After this discharge the reading of the electrometer showed which one exhibited the effect of after-discharge. By varying the time during which the condensers stood charged, curves were obtained showing how this effect varied with time. The results given for ebonite plates showed that the after-discharge increases rapidly for the first minute, and then tends to become constant. Thick plates showed a greater residual charge than thinner.—*Translated and abstracted from L'Électricien (Paris), April 20.*

The Use of the Nernst Lamp Ballast for Diminishing Voltage Variation of Lighting Circuits.

The necessity arose recently at the crematory furnace of Père-Lachaise, France, of reducing the great variations in the voltage of the electrical supply system in order that incandescent lamps might be operated from it. The tension of the supply varies from 400 to 500 volts. Three possible solutions were considered: the installation of a small local lighting equipment; the introduction of a storage battery and charging set, or the use of the Nernst lamp regulating resistance. The former two solutions were discarded on account of the expense. The latter was used, with results described here by P. Lauriol. The volt-ampere characteristic of this ballast rises gradually up to a critical point; then there is a sudden increase in the slope until a point is reached where the curve again takes about the same slope with which it started. If the ballast can be arranged so that it operates between these critical values it then becomes very effective in reducing the variations of potential which reach the incandescent lamp. The system as installed consisted in placing four incandescent lamps in series, and these in series with three of the Nernst balancing resistances. The result accomplished was that if the potential of the supply varies from 400 to 550 volts, the voltage at the lamps varies only from 372 to 433. In other words, the variation of 15.7 per cent of the system is reduced at the lamps to a variation of 7.9 per cent. If, however, the variation in the system is from 455 to 530 volts, the variation at the lamps is only from 403 to 421. The former variation of 7.6 per cent is thus reduced to a mean variation of 2.2 per cent.—*Translated and abstracted from L'Éclairage Électrique (Paris), April 20.*

Radium and Geology.

Two facts of special interest are pointed out here by J. Joly, bearing upon the explanation of the presence of radium in the earth's crust. He has found that typical rocks from the Simplon tunnel contain quantities of radium considerably in excess of the average of igneous rocks. The Simplon rocks are altered sediments, and they appear to contain sufficient radium to account for the excessive temperatures met with in boring the tunnel. And the practical suggestion is allowable, that engineers will do well to estimate the distribution of this substance before embarking on similar projects in the future. This investigation suggests that radium accumulating in great thicknesses of sedimentary deposits may enter as a factor in mountain building by raising the temperature at the base of the accumulated mass. This would lead to a lessened resistance to compressive stress and pressure from beneath. It is for future investigation to determine how far radium and uranium in the surface materials have proved a source of instability in geological history, its transport by denudation being in fact not a transport of matter only, but a convection of energy. The other fact is that a sample of red clay from a depth of 2,740 fathoms in the North Atlantic contained sixteen times as much radium as the aver-

age igneous rocks, as determined by R. J. Strutt; and a specimen of globigerina ooze from a depth of 1,990 fathoms in the South Atlantic about six times this average. When seeking an explanation of this radium, the cosmic dust of Sir John Murray at once is called to mind, and the author ventures to regard these facts as further evidence in favor of extra terrestrial origin of some portion of the radium found upon the earth.—*Abstracted from Nature (London), May 2.*

Tariffs for Electric Motive Power.

The author of this discussion, A. C. Hanson, says that he personally is not a believer in the altruistic doctrine that the chief aim of power schedules is to make an equal profit from each and every consumer. Every station engineer at heart would like to make as big a profit as possible from all his consumers, without troubling whether A is paying more than his fair share. He is quite willing to supply A, if necessary, at a loss, if by doing so he can make a profit from all of his other consumers. Moreover, the rate charged should be limited so that it is as cheap or cheaper than possible alternatives. All such schedules which compare favorably with the cost of other methods of driving are fair in his theory. Taking up the various plans which have been adopted, he says that he has never seen a sound defense of the flat-rate schedule. Something may be said, however, in favor of the flat-rate with restricted hours of use; but he has found few power users who are willing to have their supply cut off at fixed hours of the day. A plan sometimes used is that of charging a high rate during peak hours, and a low rate at other times; but, to be remunerative, the peak charges must be very high, and the mention of this rate always has a discouraging effect on would-be consumers. Any maximum-demand system is open to the grave objection that it does not take the time of the occurrence of the demand into account, and one consumer who draws a heavy power during the hours of light load pays as much as another who draws the same maximum power during the peak hours. The next system to be considered is the sliding scale, independent of the demand. This system, in a more aggravated form than usual, is the one which he has adopted, with the restricted-use rate as an alternative. It is not claimed that this system is scientific, but by means of it a good price is obtained from those consumers for whom electric motors are the only possible prime movers, and yet the power company can compete in price in other cases where a gas engine is a probable alternative. This scale is in use in Stirling, England. The charges vary from eight cents per kilowatt-hour for the first fifty kilowatt-hours per quarter to six cents for the next fifty kilowatt-hours, three and one-half cents for the next 400, three cents for the next 500, two and one-half cents for the next 1,000, and two cents for all over 2,000. In this town there are a large number of one-quarter and one-half-horse-power motors which use from fifty to sixty kilowatt-hours per quarter, and run more during the hours of darkness than during the day. Elevator motors are not desirable customers as a rule, but when enough of them are obtained they smooth out the curve fairly well. From three to five-horse-power motors consume from 1,000 to 2,000 kilowatt-hours per quarter, and at the rates given, gas-engine competition is not severe. Motor users having an aggregate of ten horse-power working steadily consume from four to five thousand kilowatt-hours per quarter, paying for this two and one-half cents, which, in most towns, is a good fighting price against a gas-engine installation.—*Abstracted from the Electrical Review (London), April 26.*

Wind Power for the Generation of Electricity.

Although frequent suggestions have been made that the winds furnish an available source of power for generating electricity, but little has been done in utilizing this power. W. O. Horsnaill here points out some of the reasons for this, and also endeavors to show under what conditions it would be profitable to employ this agent. If the velocity of the wind were constant throughout the year, or for a certain number of hours during each day, a large amount of power now provided by oil or gas engines could be much more cheaply obtained by means of wind-mills. Unfortunately, the speed of the wind is continually varying, and sometimes the velocity will scarcely rise above ten miles an hour for several days together; consequently, wind-mills may be used only for the production of power in such a form as to be capable of storage, or for running machinery which can be used intermittently whenever the weather is suitable. For storage purposes two systems are available: the raising of water into a tank, and the storage of electricity in accumulators. The former is generally out of the question because of the expense of the storage tank. Assuming that one horse-power would be required for four days of ten hours each, a period of time which must be provided against, 1,320 pounds of water would be required, assuming a fall of sixty feet. This allows nothing for the inefficiency of the apparatus. A tank for this purpose would require to be thirty-six feet in diameter and twenty-one feet deep, so that for general purposes this water storage is impracticable. Electric storage presents a more encouraging prospect. Assuming a house to require 100 lamps of twenty-one candle-power, half of which may be lighted at once, and taking 1.7 watts per candle-power, as required by the newer forms of lamp, the output of the battery required would be about eighteen amperes at 100 volts. This calls for a battery rated at about 875 ampere-hours, allowing for a period of five days calm, the lamps being used for about three hours a day. Consulting the weather charts shows, however, that no such periods occur, and even during the quietest season some charging may be effected almost every day. The author takes actual weather reports and shows that a battery rated at 360 ampere-hours would have been sufficient for the worst period found, even under the unusual assumption that fifty per cent of the lamps were in use during the period of lighting. Turning next to the question of the wheel, the difficulty here is that at lower speeds the power development is small, and at the higher speeds severe strains are apt to be thrown upon the apparatus. If the wheel is large enough to develop the full power of the dynamo when the velocity of the wind is ten miles an hour, four times this power can be developed when the velocity is twenty miles an hour. Thus it is not only necessary to control the generator for variations in speed, but to control the wheel itself in order to prevent such very excessive changes. A wheel for ordinary purposes gives out its full power only with a wind having a velocity of fifteen or twenty miles an hour, and at higher speeds it becomes desirable to decrease the wind pressure upon the sails. For the installation assumed above an average charging current of about thirty amperes will be required. The mean charging pressure will be about 130 volts, calling for an output of the dynamo of nearly four kilowatts. The wind-wheel should therefore be rated at about five brake-horse-power, and would be a mill with sails twenty-four feet in diameter if of the disc type. The old-fashioned type of wheel with four sails would be found to be cheaper and more efficient in light winds, so that it might be found desirable to install this type. The wheel may be governed either by hinging the individual vanes and allowing them to swing back with the wind, or by allowing the wheel as a whole to turn so as to present one edge more or less to the wind.—*Abstracted from the Electrician (London), May 3.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

Losing Opportunities.

Opportunities lost by central station managers to close current contracts would fill a grave big enough to bury all the managers themselves.

That is a pretty broad statement in itself, but in a great measure, it's true.

The man who has signified his interest in electricity by an inquiry is a better opportunity for you to work upon than a dozen who have not shown that interest. Yet many central station managers lose sight of that fact. They take too much for granted. They think when they've given such a man an estimate of the cost in his case, they have done all they should, or can do, and that's the end of it. That's where they lose out.

Here's a case in point.

A party called up a central station and wanted to know the cost of pumping a church pipe organ by electricity. He was given an estimate and left to figure it out for himself. As is usually the case, he figured incorrectly, and got the idea the cost was too great.

Result—a lost opportunity.

Now, if the manager receiving that inquiry had been up to snuff, he would never have been content with merely giving the estimate. He would have done the figuring himself—he would have gone right down and seen that man or men personally, or sent a good solicitor who would have a good answer or reason for every objection that came up, and point out other considerations beside cost.

Nine times out of ten, by this method, he would have been able to convince the church people of the advantages of electricity for pumping the organ.

And when he had got one church, that would have been but the opening wedge to others.

Thus, instead of losing an opportunity, a little headwork might have won a dozen contracts on this one inquiry alone. For it is usually an easier matter to convince others after you have one under your wing.

The same thing applies to all prospective electricity users.

If Mr. Dentist, Mr. Jeweler, or Mr. Manufacturer wants to know what so and so will cost in his particular case, don't tell him—go right down and see him. Don't give him an approximate estimate, for if he should adopt electric power, and your estimate falls far short, he will, quite naturally, think you made it so purposely. Even if the figures are higher than he expected, show him why and where electricity will prove its worth to him. Remember, the cost of electricity isn't the only thing to be considered. Its greater cleanliness, convenience, safety, noiselessness, flexibility and adaptability, if properly put before those interested, will more often induce people to use it, than its cost.

Man is a reasoning animal, anyway, and if he can be shown a thing adds to his material comfort, convenience or profit, he will want it, if the price is anywhere near reasonable. But he's got to be coached and made to want it, when that thing is something new, as electricity still is to many.

Suppose, for instance, a merchant has inquired as to the cost of lighting his store windows with electric light, but on receipt of your estimate, says the cost is prohibitive. What are you going to do with such a man? Are you going to let him alone till he comes around to your way of thinking, and thereby lose an opportunity, or will you do a little coaching and teaching?

Persuade him to take a pad and pencil some evening, and mark down just how many people pass his store during the

NO MATCHES NEEDED
IN AN ELECTRIC LIGHTED HOME
A twist of the wrist---a turn of the switch---and you can light one lamp or if your wiring is so arranged every lamp in the house. An unequalled protection against burglary.
Lights may be placed where no other form of illumination is possible—in clothes closets and refrigerators for instance. Confer with us as to wiring your home.
EDISON ELECTRIC ILLUMINATING CO.
360 PEARL ST. OF BROOKLYN 4640 Main

One Good Turn Deserves Another
One Good Turn—Just a Twist of the Wrist—
Gives You Light—Light in Abundance—
Just Where You Want it—if your home is wired for
ELECTRIC LIGHTING
For instance, one good turn in the lower hall and you enter and leave a lighted cellar, no matches to go out and leave you in darkness, no stumbling over barrels and boxes or butting your brains out against furnace pipes.
If you are not wired, write us. We'll help you.
EDISON ELECTRIC ILLUMINATING CO.
360 PEARL ST. OF BROOKLYN 4640 Main

Two effective street-car-cards used by the Edison Electric Illuminating Company of Brooklyn, Brooklyn, N. Y.

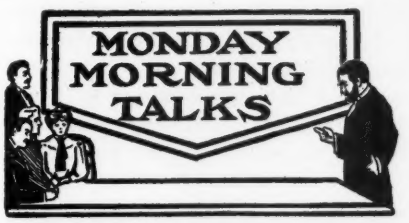
evening hours. If the average is ten a minute, in six hours until midnight, 3,600 will have passed his windows.

In newspaper parlance this would be known as circulation, but it has the advantage over the newspaper, in that the articles in his store are seen true to life, color, size and shape. Furthermore, they are seen in his windows and are inseparably linked with his name and store in the minds of prospective customers.

Can Mr. Merchant get away from such an argument on the trade and profit pulling powers of electrically lighted show windows? Not very many times.

And when one merchant has installed electric lights or an electric sign, and one woman has put in an electric flat-iron, or other electric appliance, it isn't very long before their neighbors are doing likewise.

If central station managers would just bear in mind that opportunity has a long forelock, but is bald behind, there would be more current opportunities grabbed, and fewer lost by not being properly and, above all things, promptly, taken care of.



Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

Now, boys, if I lacerate any of your feelings this morning, it is your own fault. If the cap fits, put it on.

I was mad clean through when it became known to me that some of you gentlemen had been neglecting your territory. It is up to every one of you men to remember that your territory is placed in your keeping. You are responsible for it. It is for you to make of it a field fertile with results for your company. Your interests should be centered there.

Don't imagine that chance plays much of a part in the success-making, or the failure-making of your work in your territory. It all depends on individual and hard, conscientious work—it depends on you. You alone.

Now, if any of you aren't willing to think and dig and sweat to cover the territory placed in your keeping, there are plenty of energetic fellows, who won't have to be reached through the "help wanted" liners, to fill your places.

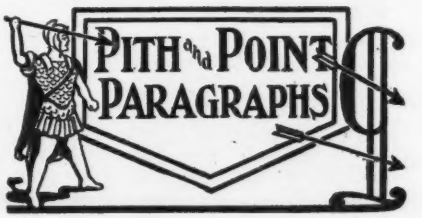
I was beginning to be proud of you fellows; proud of the fact that I had such a wide-awake bunch of good business-getters. And I tell you it hurts to have it thrown up to you that you are mistaken. That you have "another think coming."

A handsome power booklet of the Chattanooga Electric Company, of Chattanooga, Tenn. The cover of this booklet was printed in white ink on bright red linen-finished stock. The photograph shows through a cut-out, producing a very artistic effect.

Last week I was handed a number of excuses. Now, excuses, no matter how reasonable, are poor substitutes for contracts. It's the fellow who makes the situation preclude any excuses who counts in these days of hustle and ability.

One authority who knows said, "I am more convinced every day that it is ninety-five per cent man, and five per cent territory, and of the ninety-five per cent part, seventy-five per cent is hard work and twenty per cent common sense."

And he might have added "thinking" to the formula.



Under this heading we shall, from week to week, present to our readers a little series of inspirational aphorisms (original, aboriginal and selected), which will, we believe, prove stimulating and suggestive to those who are interested directly or indirectly in the sale of central station current.

Actual experience is the best teacher you can have.

To be happy—give; to be successful—take; to be both happy and successful—give and take.

There's nothing harder to bear than real trouble—except it be imaginary trouble.

You should admire the man who likes to listen to reason, because it gives you such an excellent opportunity to say a few words.

What the fool solicitor tries to do in the end, the wise solicitor does in the beginning.

The door of prosperity or success is always marked "push."

No solicitor or manager can afford to live on his reputation—however good; he must live up to it.

Don't let the good things in life do you out of the best things.

The foolish solicitor never learns even by experience; the average solicitor learns by his own experience; the wise solicitor learns by the experience of others.

A good thing needs puffing—even a good cigar.

Few men are as lucky as they seem, or as unlucky as they think they are.

Remember to remind power users that the electric motor places within their grasp a marvelous energy to be commanded at will.

No matter how much or how little power they desire, the mere twitch of the switch supplies it.

It is always ready—daytime, nighttime, overtime, all the time.

Whether they use it or not, the power is there awaiting their immediate call every hour of the day, every day of the year.

Individual motors are the most modern examples of electric power economy.

With them a breakdown of the entire shop system becomes a thing of the past.

With electric motors valuable floor space is not wasted, and a plant becomes more efficiently productive.

And, best of all, it will save them from twenty-five to forty per cent in their power bill, all things considered.

When a machine is not working it ought not to be eating up power, but the belting and shafting system means that whenever

a machine is idle the power user is paying for power that does not produce product.

With individual-motor equipment a manufacturer pays only for power that each machine uses—idle machines consume no power on the individual-motor-equipment plan.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

Chattanooga, Tenn.—The Chattanooga Electric Company, of Chattanooga, Tenn., with Byron T. Burt at the helm as general manager, has accomplished phenomenal results in the way of lining up new business. Its record of a yearly increase of

The cover of one of the Bedford (Ind.) Light, Heat and Power Company s "Electrical Bulletins." It is illustrated throughout in the Colonial style, and is what may be called a very nobby bulletin.

sixty per cent in the amount of power and light business secured is something to feel justly proud of, and one which few central stations purveying electricity can boast of. A great deal of the credit must be given to Mr. Burt for this wonderful increase. He is a hustler, an organizer, and a thorough electrical man who knows all the ins and outs of the central station business. Having the courage of his convictions, he stops at nothing, and the esteem in which he is held among the electrical fraternity is something that few men can boast of.

Like the majority of hustling and aggressive central station managers he is a firm believer that an electrical bulletin and the other good direct-by-mail advertising in the form of booklets, folders, mailing cards, facsimile typewritten letters, etc., are wonderful helps in getting people interested in electric current and in closing contracts for current.

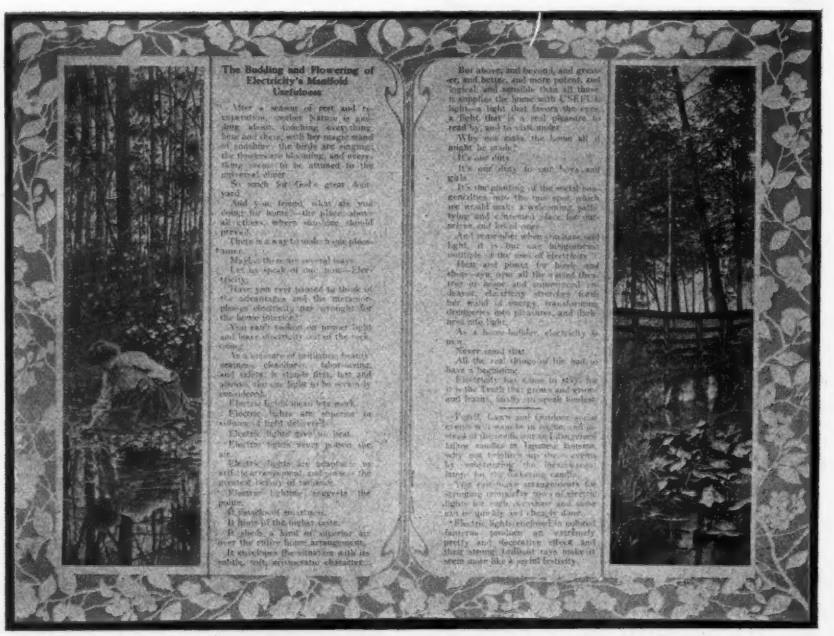
This company does not stop with advertising and say "amen." It backs up its direct-by-mail advertising by a well-drilled corps of solicitors in such an efficient way that it obtains the maximum results from its expenditure.

Such high-class advertising as it mails out can not help reaching its mark and securing its readers, for the pure, simple and obvious reason that it is a physical impossibility for any one to receive it and not be deeply impressed and influenced.

The bulletin of this company will vie

KNIGHT & DAY
IF YOU COULD ONLY
—Yes, if you could stand in your doorway every night and induce every passerby to look at your goods, you'd probably increase your sales.
Of course you can't do that. But you can do the next best thing. What's that?
Why, employ Electricity and display your goods attractively at night as well as by day.
This means that your goods can talk to thousands of people for several hours after closing time.
It means extra sales next day.
It means more money for you.
You may be strictly up-to-date in everything in your business, but if you're not
by electric light,
you're losing a big share of trade that could be induced to come your way.
Can you afford to do that?
When may our representative call on you with facts and figures?
Bedford Light, Heat & Power Co., Bedford, Indiana

A reproduction of a mailing card sent by the Bedford Light, Heat and Power Company, of Bedford, Ind., to merchants and business men to interest them in store window lighting.



Two of the inside pages of one of the business-getting bulletins of the Chattanooga Electric Company.

with any gotten out by any central station in the United States, and that means with any published on this great spherical earth of ours. It is a sixteen-page bulletin, well-printed in colors on the best of enamel book paper. A handsome, attractive and suggestive cover design is gotten up each month for the bulletin, which goes a long ways in catching the receiver's attention the moment it is taken from the envelope. The interior illustrations go even further in arousing the curiosity of a person to read what it is all about, and the reading matter itself is so interestingly written that it is most likely that the whole bulletin will be carefully perused from beginning to end before laid down or passed on to another.

Electricity
Good Servants
THE ELECTRIC FLAT IRON
READ INSIDE
The Story of Mrs. John Higgins' Electric Home and Her Electrical Servants

A novelty folder of the Chattanooga Electric Company, which forms part of its resident advertising service.

Through the bulletin the people of Chattanooga come to be familiar with electricity. It is talked of in the family, talked of at the table, in the store, office or factory. It becomes a familiar topic instead of a mysterious, far away, visionary subject as it used to be until the Chattanooga Electric Company began to educate the public. One of the best things about the company's bulletin is that it discusses many different phases of electric service in each issue. It makes it a point to cover the whole field of electricity in each number. There is something in it for everybody—housewife, husband, merchant, manufacturer, barber, printer, etc.

A page or two for the household about the numerous electrical devices for household conveniences, the porch light and the value of electricity as a method of lighting the home.

An article or so appears about electric power which does its part to gradually win power users to the right way of thinking.

Something about the electric sign, window and store lighting, and the electric arc light is also sandwiched in as food for thought for the merchant and as ammunition for the company.

Each and every article in this little bulletin has its part to play and they act their parts well—it is an "all star" production.

Besides this bulletin the company mails out two special direct-by-mail advertising services in the form of booklets, mailing cards, folders, etc.—one to merchants and the other to power users.

Its store service consists of twelve different pieces of advertising per year—one each month, while its power service consists of twenty-four pieces per year—two each month.

Such persistent advertising could not fail to win out against the most stubborn opposition, but when the persons aimed at are willing to be convinced, the results from such advertising are almost beyond your power of imagination.

Another thing that this company does not overlook is the advantage to be gained by being situated in the business section of the city, and its offices are well arranged for the convenience of the public, as well as its employés.

The company has a very modern General Electric Curtis turbine plant, with only one reciprocating engine of 400 horse-power, and notwithstanding it has just completed the installation of a 1,000-kilowatt turbine and the necessary boilers, and remodeling of its building, further improvements and additions and extensions are being made. These include the installation of a 1,000-kilowatt Curtis turbine, four 408-horse-power Babcock & Wilcox boilers, condensers, cooling towers, and a 200-foot steel self-supporting stack twelve feet inside diameter.

The South may feel proud of this down-to-date electrical central station plant, and many a southern company would be its own best friend by following its example.

Bedford, Ind.—In the fair state of Indiana lies the hustling, bustling town of Bedford with about 10,000 inhabitants, but with a central electric plant that would be a model to central stations in a town of many times the population.

The only thing where the Bedford Heat, Light and Power Company is backward is the fact that it does not carry a day load, but this it expects to remedy this summer.

J. R. Voris, the progressive manager of the company, is a firm believer in advertising and a hustler from the word go.

He has found, like many other observing managers, that a bulletin is one of the

best assets a central station can put out as a new-business-getter.

The "Electrical Bulletin" of this company is gotten out to tell its customers and prospects of the superiority of electricity, to remind them of that superiority and inform them of more ways in which they can profitably employ electric current, to create and foster a friendlier sentiment toward their company, to militate against municipal ownership agitation and to educate the public electrically and reduce the complaint roll to the minimum notch. It is a dignified, well-dressed and elegant representative of the company. It adds prestige to the company. It makes friends. It clears the way for the solicitor and goes far towards making it easy for him to close contracts, where in the absence of the bulletin, he would find the path thorny, and the amount of explanatory work infinitely greater.

This bulletin is not gotten up by the company itself but is purchased in whatever quantities it wishes from a firm making a specialty of supplying central stations with bulletins.

To all appearances, so far as the general public is concerned, the bulletin is issued each month by the Bedford Heat, Light and Power Company, as the company's name appears on the front cover as the publisher and in a special advertisement on the back cover.

In this way it obtains a bulletin which is equally as good as any gotten out by any of the central stations in the large cities and at almost one-tenth what it would cost it if it attempted to get out one itself.

The reason for this is that these bulletins are sold to a large number of central stations and the expense of the designs, drawings, cuts, etc., is divided among the numerous buyers.

Besides the bulletin this company mails out special pieces of advertising, devoted to store and store-window lighting, as it finds it a great aid in lining up the merchants to go after them with a series of folders, booklets and mail cards.

Such direct advertising following at stated intervals close on the heels of one another it finds is bound to strike its man sooner or later at just the psychological moment when he is in the humor to listen and heed. They never fail to make the way much easier for the solicitors. They seldom fail to crown their efforts with success. The solicitors do not have to waste valuable time on impossible people. Their work is confined, instead, to favorable prospects—prospects who often are interested enough to write or telephone their office.

Mr. Voris is a very busy man, being interested also in a bank, but he never fails to find time to properly look after the welfare of this company and his efforts are reaping a good harvest of good paying new business.

This company produces gas as well as electricity, and is building up a good business in gas as well as in electricity.

From what the writer has gathered from his visit to Bedford he has every reason to believe that it is a coming town.

Large quarries are situated near the city supplying work to a large number of its citizens. It is located in the midst of fertility and the people on the whole are wide-awake and progressive and will use electricity in every way possible if shown where it will benefit them.

The fact is that the Bedford Heat, Light and Power Company is extremely fortunate in being located in such a city and we will not be surprised if electricity will reach its brightest development in this town. Here's hoping.

Illustration showing two folders sent out by the Chattanooga Electric Company, to prospective power users. The one entitled "He can't see it"—is shown opened out to give an idea of the effective arrangement of the folder as a whole.

The West Virginia Independent Telephone Association.

The annual meeting of the West Virginia Independent Telephone Association was held at Wheeling, W. Va., May 9 and 10. Several important papers were read, and the subject of telephone construction and telephone standards was given considerable discussion. The Hon. James B. Hoge, president of the International Independent Telephone Association, made a very interesting address upon the telephone situation in the country at large. The subject of rural telephones was discussed by T. B. Lee, general manager of the State Mutual Telegraph and Telephone Company, Waynesburg. An address on independent telephone securities was delivered by A. C. Davis, of the West Virginia Company, Parkersburg. The right of territory was the subject of an able address by J. W. Down, of Buckhannon. Frank Hart, of Pittsburg, Pa., superintendent of the long-distance department of the Pittsburg & Allegheny Telephone Company, spoke on the value of good toll lines.

New officers were elected for the ensuing year as follows: president, A. C. Davis; first vice-president, J. H. Wise; second vice-president, W. M. Line; vice-president third district, J. W. Davis; vice-president fourth district, Hugh Amos; vice-president fifth district, L. H. Hutchinson; secretary, W. C. Handlan; treasurer, Lloyd Beeghly; member of the advisory board, J. W. Barnes; executive committee: W. C. Handlan, J. W. Barnes, L. H. Hutchinson, E. K. Hertford and A. C. Davis.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The "Match-less" Light.

The accompanying illustrations show a new electrical device which has been placed on the market by the Match-less Light Company, Caxton Building, Cleveland, Ohio. This is a combination electric cigar-lighter and incandescent inspection lamp for automobiles. It is connected by a cord to the sparking batteries. The manufacturer expects that this device will be of great utility to users of automobiles. It is impossible to light a cigar while the machine is in motion without a device of this nature. The other valuable feature is the facility for inspection and repair which it brings about should anything happen to the car during a run.

THE "MATCH-LESS" ELECTRIC FLASHLIGHT.

THE "MATCH-LESS" CIGAR-LIGHTER.

The officers of the Match-less Light Company are: L. P. Sawyer, president; Milton Hartman, vice-president and general manager, and C. L. Gates, secretary-treasurer.

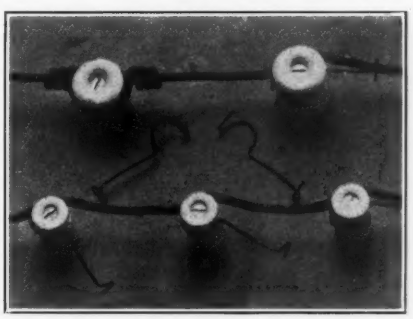
Pittsburg Car Mileage.

The annual report of the directors of the Philadelphia Company, Philadelphia, Pa., presented by President James H. Reed at the annual meeting of the stockholders, held at Pittsburg, Pa., on May 6, shows that the company and subsidiary concerns have under lease in western Pennsylvania and West Virginia 428,584 acres of oil and gas territory. The company sold during the year 36,197,647,021 cubic feet of natural gas. The net earnings are $3,322,465.19. The gross earnings of the Pittsburg Railways Company, controlled by the Philadelphia Company, are placed at $10,232,619.88, the net earnings being placed at $4,544,565.20. The number of passengers carried was 203,411,809, the car mileage being 36,125,014 miles.

The following officers and directors of the Philadelphia Company were elected: President, James H. Reed; vice-president, James D. Callery; secretary, W. B. Carson; assistant secretary, J. L. Fister; treasurer, C. J. Braun, Jr.; assistant treasurer, J. W. Murray; auditor, C. S. Mitchell; general manager, Joseph F. Guffey; general superintendent, J. K. Beatty; general contracting and purchasing agent, Matthew Bigger; land agent, W. R. Truby; directors, James H. Reed, James D. Callery, George H. Frazier, H. J. Bowdoin, George E. McCague, Joshua Rhodes, Patrick Calhoun, Richard Y. Cook, B. S. Guinness and Edwin W. Smith.

The "Economy" Wire Tie.

The accompanying illustration shows the "Economy" wire tie, placed on the market by the Wilson & Drew Manufacturing Company, 70 West 100th street, New York city. As may be seen from the illustration, this wire tie is designed to be a great time and material saver. Its object is to provide a simple and cheap device which not only securely grips and binds the wire to the insulator, but may be instantly adjusted or removed, and no tools are required.



THE APPLICATION OF THE "ECONOMY" WIRE TIE.

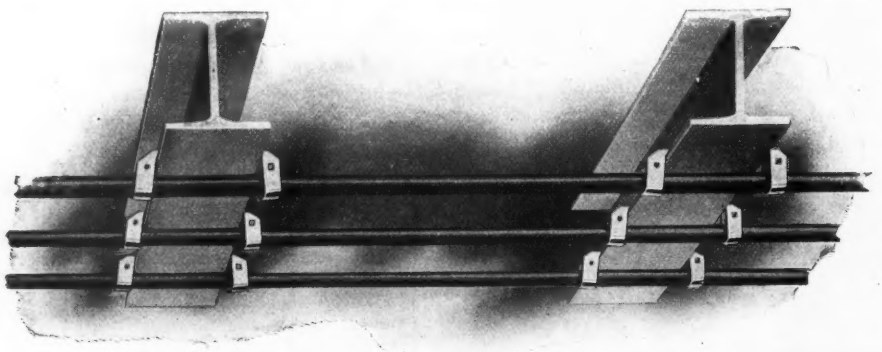
In applying this wire tie, the long hook is slipped over the wire close up to the insulator, the curved portion of which fits into the bent wire form. The long end of the wire with the short hook is then used as a lever to draw the wire tightly against the insulator, and the short end is hooked over the wire at the proper distance from the cleat.

Canadian Bell Telephone Company to Make Extensions.

The Bell Telephone Company of Canada, it is announced, proposes to spend $2,500,000 in extensions and improvements to the system throughout the Dominion of Canada during this year. Of this $800,000 will be expended in Montreal. The improvements in this city include the rearrangement of the entire service. In this connection it has been decided to establish a new exchange in the north end of the city. It is stated that the growth of business through Canada during the past year has been phenomenal, and that the company is compelled to expend large sums to meet the demand for telephone service all over the country.

A New Conduit Clamp.

The accompanying illustration shows a new conduit clamp which has been placed upon the market by Pass & Seymour, Incorporated, Solvay, N. Y. As may be seen, this clamp is neat, compact, and is guaranteed by the company to be of sufficient strength to stand up under the most severe service. It is easy to install, the only tool required being a screw-driver.



P. & S. Conduit Clamp Attached to Girders.

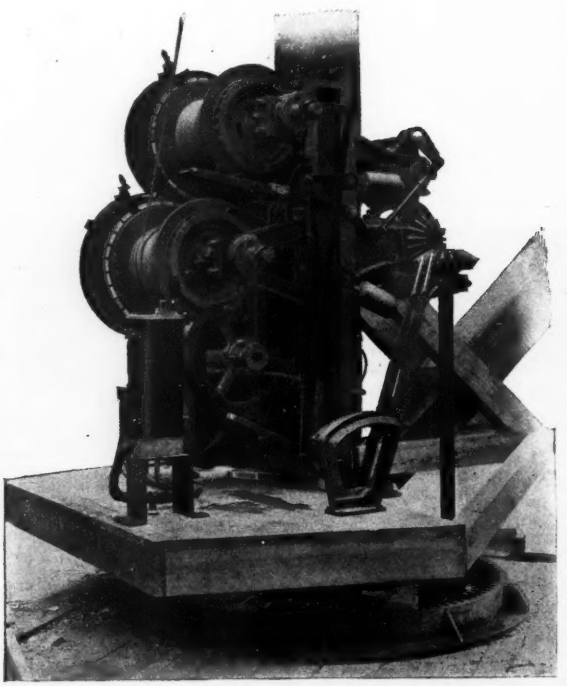
A Portable Electrical Grinder.

The accompanying illustration shows the portable electrical grinder placed on the market by the Cleveland Armature Works, Cleveland, Ohio. This motor weighs thirty-five pounds, and is easily handled. Where the work is stationary a spring attachment may be used. There are innumerable places where this portable motor may be used. In addition to stationary work it is finding a wide application for grinding rails for bonding, for armature finishing and numerous other uses. The motors are wound for 500 volts.

Portable Electrical Grinder.

New Electric Mast Hoist.

A new type of electric mast hoist developed by the Lidgerwood Manufacturing Company, of New York, to meet some exacting modern engineering conditions, and one of its applications are shown in the accompanying cuts. The special feature of the new hoist is that it is wholly complete in itself, containing not only the electrical motor, controller and resistances, the two drums for operating the boom and fall lines of the derrick, but also the boom swinging gear, thus giving to the operator full control of every operation of his derrick while he stands constantly facing his work.



Electrically Driven Mast Hoist.

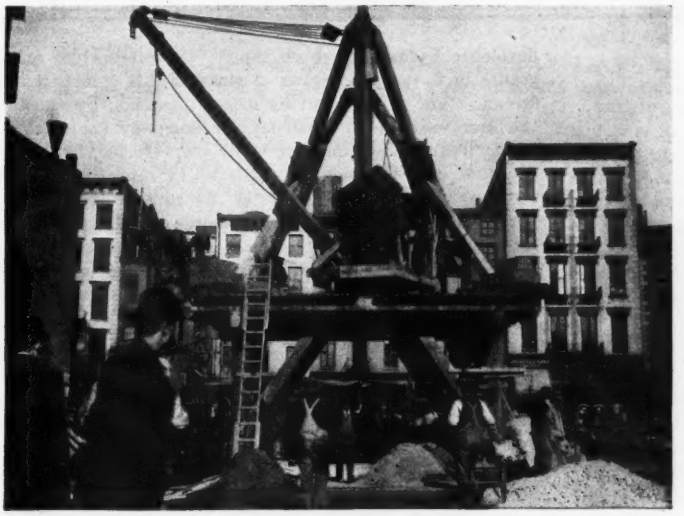
Compactness was the dominating requirement for the new hoist, but there was also included a demand for high power, perfect reliability and handiness in action. In preparing the foundations of such enormous modern buildings as the new terminal buildings of the Hudson River tunnels at Church, Cortlandt, Dey and Fulton streets, New York, and the City Investing Building opposite, where many caissons were to be sunk closely together to the rock a hundred feet or so below the surface, it was necessary for rapid and economical working to equip travelers each with a number of derricks and to keep the size of the travelers down to the smallest possible dimensions.

The new Lidgerwood electric mast hoist meets these conditions. It eliminates the space necessary for the leads when bull wheel derricks and separate hoists are employed. In some cases, such as are shown in Fig. 2, two booms operated by the electric hoists were mounted on one traveler. In other cases two derricks operated by the electric hoists were mounted on diagonally opposite corners of a square traveler, and these left room for two bull wheel derricks to be mounted on the other two corners. The new hoist, as shown in the cut, is operated by a 250-volt, direct-current General Electric motor. They are also made to operate on alternating current with induction motors.

The hoist has a nominal capacity of 4,000 pounds lifted at a speed of 130 feet per minute. The drums, which measure twelve inches in diameter and nineteen and three-quarters inches face, are each complete with brakes, ratchets and pawl, giving full control over them at all times. In addition to the regular brakes operated by foot levers, these and all other Lidgerwood electric hoists are fitted, when required, with electric solenoid brakes. The solenoid brake is in many instances very desirable as a matter of convenience and added safety. This brake is applied to the shaft of the electric motor. When the operating current is turned on to the motor it passes through the coils of the solenoid, lifts the armature and automatically releases the brake. When the current is shut off, or in case of its being cut off by accident, the armature falls and its weight sets the brake with power sufficient to hold the entire load of the hoist.

Persons familiar with hoisting work

will see from the illustration that all the operating levers, pawls and controller handle are arranged so as to be in the handiest positions possible for the operator.



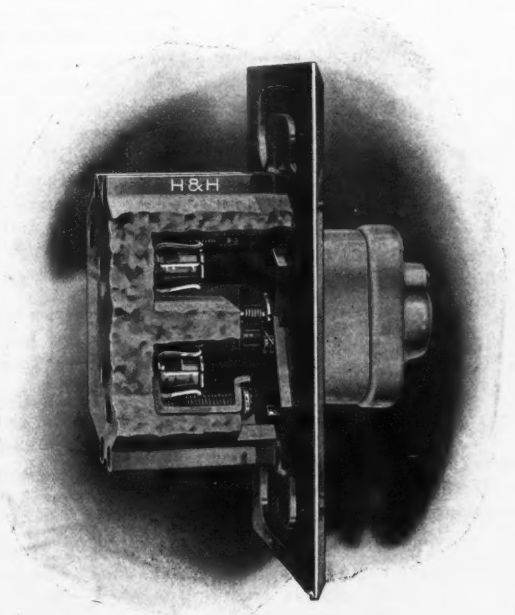
ELECTRICALLY DRIVEN MAST HOIST.

This is a feature of the entire new line of Lidgerwood electric hoists. They are all arranged so that every operative part is ready in hand and in plain view and also so that hoisting engineers used to Lidgerwood steam hoists find everything on the electric hoists convenient for their use. Any person who has watched a hoisting engineer at work will appreciate the importance of this feature. The hoisting engineer has his attention intently fixed at all times on the derrick load or on the signal man directing his movements. He has no time or chance to look at his engine. He clutches a lever here, presses a foot brake there, catches or releases a pawl and turns on or turns off the power and the machine must answer his every movement at once and with certainty. If it does not, life and property are endangered. An engineer used to a steam hoist does not have to relearn his trade when he is called upon to handle a Lidgerwood electric hoist.

The use of electric hoists is increasing with remarkable rapidity. This is not only true in cities where current is naturally becoming more and more available, but also in remote regions where current has to be specially generated for this and other power purposes. A large percentage of the mining hoists now being built are for electric operation, and many large engineering undertakings are supplied with power throughout from their own generating plants and also from city service mains. The economy and ease of distributing the power in this way are important factors in increasing the demand for electric hoists and other electrically operated machines.

The "H. & H." Flush Receptacle.

The accompanying illustration shows the new "H. & H." receptacle placed on the market by the Hart & Hegeman Manufacturing Company, Hartford, Ct.



H. & H. FLUSH RECEPTACLE.

The doors, through which the plug passes, operates automatically, and the user has little difficulty in operating this receptacle. The plug has a thirteen-thirty-second-inch notch, permitting the use of a No. 16 New Code portable cord, and is fuseless. The porcelain base is so constructed that it is impossible to short-circuit the receptacle when inserting the plug. There is space enough in the plug to permit of a knot being tied in the cord. The design of the plate is such that when used in a gang with switches, the appearance is harmonious. The screw holes are the same distance apart as push switches, and the receptacle will fit in the same box. The plates are furnished in nickel, polished brass, dull brass or polished bronze finishes.

Crocker-Wheeler Motors in a Rolling Mill.

The largest order for steel rails ever placed with a single concern was made public May 11. This was the order for 150,000 tons of steel rails placed by the Harriman lines with the Tennessee Coal and Iron Company for delivery after March, 1908. In order to handle its greatly increased business the Tennessee Coal and Iron Company has just placed an order with the Crocker-Wheeler Company, of Ampere, N. J., for the complete electric motor equipment of its new steel rail mill at Birmingham, Ala. The Crocker-Wheeler Company has recently been obliged to open an office in Birmingham to handle the rapidly increasing business in this section. The order includes fifteen Crocker-Wheeler form W rolling mill motors. The line of form W motors is designed for the arduous service of rolling mills, and has attracted very favorable attention in the steel world for its ruggedness and simplicity of design. The order aggregates about 575 horsepower.

Among the other purchasers and users of the form W rolling mill motor are the following: Alliance Machine Company, Bethlehem Steel Company, Carnegie Steel Company, Illinois Steel Company, Lorain Steel Company, Mineral Point Zinc Company, Morgan Engine Company, National Tube Company, Pennsylvania Steel Company, Shelby Steel Tube Company, Tennessee Coal, Iron and Railroad Company, United Engine and Foundry Company, Youngstown Sheet and Tube Company. These companies are installing time and labor-saving electrical apparatus as fast as its fitness is demonstrated.

Current Electrical News

DOMESTIC AND EXPORT.

CAPITAL OF THE CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY INCREASED—Stockholders of the Central and South American Telegraph Company, at a special meeting held last week, voted to increase the capital stock from $8,000,000 to $12,000,000. Of this amount $2,000,000 is to be distributed to shareholders of record May 14 as a twenty-five per cent dividend; the stock to be issued on June 1. The remaining $2,000,000 is to be issued as the directors determine. It was explained that betterments and certain concessions in the territory where the company operates have been capitalized for $2,000,000, and this amount is to be distributed as a dividend.

INCORPORATION OF CENTRAL INDIANA LIGHTING COMPANY—Articles of association have been filed by the Central Indiana Lighting Company with a capital stock of $3,000,000. The company is a branch of the National Heat, Light and Power Company of New York, which is operating light plants at Taylorsville, Jerseyville, Robinson, Charleston, Paris and Pana, Ill.; Lexington and Marshall, Mo.; Hoosick Falls, N. Y.; Bennington, Twin City and Brattleboro, Vt. The incorporation papers set out that the purpose of the new organization is to operate gas, electric and heating plants in the cities of Bloomington, Columbus, Shelbyville, Fairmount, Summitville, Alexandria and Elwood. The incorporators are W. H. Wherry, Jr., John W. Tobin and Ira L. Meloon, all of New York city.

TOLEDO RAILWAYS AND LIGHT COMPANY—A special meeting of the stockholders of the Toledo Railways and Light Company has been called for June 10, at 10 A. M., in Toledo, Ohio. An agreement authorized by three-fourths of the directors is to be executed, purchasing from the Toledo Gas, Electric and Heating Company its entire property and assets, including franchises, rights and privileges of all kinds. The Toledo Gas, Electric and Heating Company is an Ohio corporation, and is now engaged in supplying both electricity and artificial gas for power, light, heat and fuel purposes. The Toledo Railways and Light Company purposes to continue this business. In connection with the matter an increase of $3,000,000 in the capital stock will be voted upon, increasing the total stock from $12,000,000 to $15,000,000.

SOUTHERN COLORADO POWER PLANT DEVELOPMENT—The company, backed by a capital of $10,000,000, which has a three months' option on the Trinidad Electric Street Railway; the Trinidad Light, Power and Manufacturing Company; the Walsenburg electric light plant and other electrical plants in southern Colorado and northern New Mexico, and which intends to establish a plant that will supply electrical power and light to the towns and camps in southern Colorado and northern New Mexico, was granted a franchise on May 10 for twenty-five years over all county roads by the county commissioners, for the erection of poles and transmission lines. The grant stipulates that the plant must be in operation within one year. The franchise was granted in the name of C. L. Hendershot, who is acting for the company. It is understood that similar franchises will be asked for in adjacent counties.

COMPENSATION FOR POWER RIGHTS IN NEW YORK STATE TO BE DEMANDED—Governor Hughes has demanded that power companies securing from New York state valuable grants shall compensate the state for the privilege. The views of the governor on this important question were communicated on May 14 to the promoters of the Long Sault Development Company's bill, which he refused to sign unless a provision was inserted amply compensating the state for the rights conferred by the proposed charter. The power people consented to the change and an amended bill was later offered in the senate containing the scale of rates proposed by the governor. It is estimated that the revenue which the company will have to pay the state annually, when in full operation, will be $90,000 a year. The Long Sault company proposes to develop electrical power on the St. Lawrence river and its charter grants to it valuable rights of state in this international boundary stream. The amendment as to compensation provides that during the first year of its existence the company shall pay $10,000, the second year $15,000 and the third year $20,000, by which time it is expected that the company will be in operation. After that the company is to pay the state at the rate of seventy-five cents per horse-power for the first 25,000 horse-power developed, fifty cents for the next 75,000 horse-power developed and twenty-five cents for all over 100,000 horse-power, but a minimum of $25,000 must be paid to the state.

READY TO BEGIN CHICAGO TRACTION REHABILITATION—Rehabilitation of Chicago's street-car service under the terms of the settlement ordinances has been officially begun. The joint board of supervising engineers will be organized and will take up at once the plans for the reconstruction of the city railway's lines and for their operation in partnership with the city. With the appointment of the city's representative by Mayor Busse and with his confirmation by the council, the board has been completed as follows: Bion J. Arnold, chairman and chief engineer, selected by agreement between the city and the companies; Charles V. Weston, representing the city; Harvey B. Fleming, representing the City Railway. Mr. Arnold announced the appointment of George Weston, a brother of the city's representative, as assistant chief engineer. Professor Mortimer E. Cooley, who was one of the leading candidates for the city position, will be retained in preliminary stages of the reconstruction as a consulting engineer. The first business to be taken up is the organization of the board's work into various branches as follows: Division of trackage and roadbed, to carry out the reconstruction of the tracks under the direction of an assistant engineer; division of electrical power, to work out the problem of the distribution of the power required for the new system under the direction of an electrical engineer; division of power-house construction, to supervise the building of new power-houses if it is decided to manufacture instead of purchase current; division of cars and operation, to supervise the rehabilitation of all rolling stock and put into effect through routes and other service regulations; division of subways, to have charge of the construction of the underground street railway system as soon as authorized by the city council and in the meantime to supervise the rebuilding of the river tunnels in conformity with that plan; division of accounting and auditing, to have charge of all bookkeeping, including the division of receipts between the city and the company.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

American Society of Mechanical Engineers. Semi-annual meeting, Indianapolis, Ind., May 28-31.

International Independent Telephone Association. Chicago, Ill., June 4-6.

National Electric Light Association. Annual meeting, Washington, D. C., June 4, 5, 6 and 7.

American Railway Master Mechanics' Association. Annual meeting, Atlantic City, N. J., June 12-14.

Pacific Coast Electric Transmission Association. Los Angeles, Cal., June 18-20.

Association of Railway Telegraph Superintendents. Annual meeting, Norfolk, Va., June 19.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 20-22.

American Institute of Electrical Engineers. Annual meeting, Niagara Falls, N. Y., June 25-28.

Society for the Promotion of Engineering Education. Case School of Applied Science, Cleveland, Ohio, July 1-3.

National Electrical Contractors' Association. Annual meeting, New York city, July 17-19.

International Association of Municipal Electricians. Norfolk, Va., August 20-22.

Ohio Electric Light Association. Annual meeting, Toledo, Ohio, August 20-22.

ELECTRIC LIGHTING.

SOUTH NORWALK, CT.—The city has appropriated $27,000 for the enlargement of the municipal electric light plant.

VALLEY CITY, N. D.—Residents of Valley City have voted to sell the city electric light plant, which has not been successful.

ITHACA, N. Y.—The Ithaca Electric Light Company has let a contract for improvements to its system which will involve an expenditure of $10,000.

DOVER, N. J.—The entire stock of the Dover Electric Light Company has been purchased by E. L. Thompson, of New York, a summer resident of Dover.

UTICA, N. Y.—At a meeting held at Deansboro the town board of Marshall granted a franchise to the Oriskany Hydro-Electric Company to build a transmission line through that town.

JACKSONVILLE, FLA.—A. A. Kind, electrical contractor, of Jacksonville, has been awarded a contract to furnish Green Cove Springs with an electric light and water plant. Work will begin as soon as possible.

CINCINNATI, OHIO—At the annual meeting of the Cincinnati Gas and Electric Company, C. L. Harrison and L. J. Hauck were elected directors to fill the vacancies caused by the retirement of W. S. Rowe and A. Howard Hinckle.

SEGUIN, TEX.—The waterworks trustees have been placed in charge of the newly acquired electric light plant and have already taken steps looking toward its modernization. Ten thousand dollars will at once be put in the plant.

ATHENS, OHIO—A contract for enlarging and equipping the city electric light plant has been awarded to the Ross Hull Company, of Columbus, and the Post-Glover Electric Company, of Cincinnati, amounting to about $5,000.

HAMILTON, OHIO—The Harrison Light and Water Company, of Harrison, was sold on May 1. It is understood that the bondholders' committee, under the direction of President Charles A. Hinsch, of the Fifth National bank, of Cincinnati, bid in the property.

HAZLETON, PA.—The advent of the new Consumers' Electric Light and Power Company has brought about a reduction in the price of light, the Hazleton Electric Light Company issuing notice of an eighteen per cent reduction on a three-year contract and twenty-five per cent on a five-year contract.

ASHLAND, NEB.—The plant of the Ashland Light, Mill and Power Company, located on Wahoo creek, north of Ashland, burned on May 8. Repairs aggregating $3,000 have recently been made and bring the loss up to $10,000, with $3,000 insurance. Omaha capitalists are interested in the company.

BROCKTON, MASS.—The Edison Electric Illuminating Company, of Brockton, has placed contracts for the immediate erection of a 5,000-horse-power plant in East Bridgewater, for the production of electrical energy to be sold to consumers in this district, and also for the addition of a $100,000 annex to its School street plant in Brockton.

AUGUSTA, ME.—The city of Augusta has entered into a new contract for lighting with the Kennebec Light and Heat Company. The price for arc lamps has been reduced from $75 to $65 per annum, and that for street incandescent lamps from $36 to $30. The lighting company has also made a reduction in the rates for commercial service.

WASHINGTON, D. C.—H. G. and L. G. Dill, consulting and contracting engineers, of Washington, have been awarded the contract for erecting a new power-house for the Roanoke Heat, Light and Power Company, Roanoke, Va. The building specifications call for a steel frame and reinforced concrete floor. The cost of the building will be $25,000.

MASSILLON, OHIO—The plants of the A. Beyer Electric Company, of New Philadelphia and Canal Dover, have been purchased by a syndicate of Cincinnati capitalists who will incorporate a company to be known as the Tuscarawas County Electric Light and Power Company. The company has contracts for lighting the cities of New Philadelphia and Canal Dover.

SEATTLE, WASH.—Bids for the supply of equipment to double the capacity of the city lighting plant will be received. The apparatus advertised for is: two 8,000-horse-power turbines; two 4,000-kilowatt, 2,300-volt, sixty-cycle, three-phase, revolving-field, alternating-current generators; nine 1,500-kilowatt, 2,300-35,000-volt transformers for the generating station and eight 54,000-2,500-volt transformers for the substation.

LANCASTER, PA.—Articles of consolidation of the Stroever and Leland Electric Light companies have been filed in the recorder's office. The new corporation will be known as the Manheim & Mount Joy Electric Light Company. The capital stock is $10,000, and the directors are: J. H. McNeal, president; H. C. Case, L. N. Endebrock, secretary, all of Philadelphia, and E. L. Baker and George R. Heisey, of Lancaster.

TORONTO, ONTARIO—The Toronto Electric Light Company has been granted authority to increase its capital from $3,000,000 to $4,000,000. The Robert Simpson Company has also secured an increase of capitalization from $1,000,000 to $2,500,000 and is authorized "to provide for the acquisition, manufacture, use, sale and other disposition of electricity for heat, light and power for the purposes of the company and for the sale and transmission to others of any surplus of the same."

LARAMIE, WYO.—It is learned that the electric light plant of this city, owned by the Laramie Light and Power Company, in which Denver capital is interested, was sold March 28 to a syndicate represented by J. A. Arbogast, of Waynesburg, Pa., and E. A. Phinney, of Ouray, Col. Arbogast is president and Phinney secretary of the new company. The plants at Ouray and Laramie are to be consolidated under the same management and the plant at Laramie much improved and enlarged.

LITTLE FALLS, N. Y.—As a sequel to the purchase of valuable water rights on the East Canada creek, near Ingham's Mills, some weeks ago, by the East Creek Electric Light and Power Company, comes the announcement that the company has made tentative plans for the erection of a large power plant at this point during the coming summer, and that already a surveying corps has been located at Ingham's Mills to make the necessary preliminary survey. The corps is in charge of Stanley Dean, of New York.

ALBANY, N. Y.—The state commission on gas and electricity has approved the application of the New York & Ontario Power Company for a certificate of authority to do business and consented to the issuance of $150,000 in stock and $150,000 bonds. The original application was for consent to issue $2,000,000 bonds and $2,000,000 stock, which subsequently was amended to $250,000 bonds and $250,000 stock. The company will sell electricity for light, heat and power in the city of Ogdensburg, the village of Waddington and the towns of Waddington and Lisbon.

ST. PAUL, MINN.—Work has been commenced by the St. Anthony Falls Water Power Company on a new electrical power-house on the east bank of the Mississippi at Minneapolis. The company will put in a plant at an expenditure of $300,000, nearly $1,000,000 being saved due to the fact that the present dams in the river will not have to be altered. The new power-house is expected to generate at least 14,000 horse-power, making the total horse-power generated in Minneapolis 58,000. Just what the power will be used for the officials refuse as yet to announce.

SPOKANE, WASH.—G. Scott Anderson, of Wallace, is at the head of a corporation which will erect a power plant on Big Creek, southeast of Wardner, for the purpose of supplying the mines of that section of the Coeur d'Alenes with electric power. Articles of incorporation are now being drawn for the company, which will be known as the Inland Power Company. The incorporators include Stephen P. Wright, of Butte; G. Scott Anderson, of Wallace; M. W. Bacon, of Butte; William H. Hall, of Butte, and James H. McDoney, of Chicago. The company will expend about $300,000 on the building and equipment of its plant. It owns the right to a large volume of water from Big Creek, and will be able to supply the mines with all the power necessary. The large increase in mining operations in the Coeur d'Alenes has caused a great shortage of power, for the Washington Water Power Company is unable to supply the demand. It is said that even when that company's new line is in operation the supply will be inadequate.

ELECTRIC RAILWAYS.

MARENGO, IOWA—The board of directors of the Marengo & Midland Railway Company has authorized the closing of a contract for a survey of the proposed line.

ALBANY, N. Y.—The board of railroad commissioners has consented to the issuance of a first mortgage for $1,000,000 by the Syracuse & South Bay Railway Company.

WINONA, MINN.—The statement is given out by officials of the Chicago Great Western road that within the next year the Rochester-Winona branch of the Great Western will be electrified.

MINNEAPOLIS, MINN.—A certificate of incorporation for the Twin City & Lake Superior Railway Company, of Maine, has been filed with the secretary of state. The company is capitalized at $7,000,000.

PITTSBURG, PA.—The Waynesburg & Washington Street Railway Company has been formed to build a traction system down Ten Mile Creek into Washington county and to the Monongahela river at Millsboro.

LINCOLN, ILL.—The Lincoln Street Railway Company has been absorbed by the Lincoln Railway and Light Company with a capital of $150,000. W. H. Schott has been made chief engineer, and J. H. Thorpe manager. The company will put the present line in first-class condition, and will also install a heating system.

COLUMBUS, OHIO—At a meeting of the stockholders of the Cincinnati & Columbus Traction Company held at Cincinnati the following directors were reelected: H. H. Hoffman, General Lewis Seasongood, Henry Burkhold, Harry J. Gibson, J. C. Thoms, J. A. Andrews, Burton Fox and Richard C. Swing.

BROOKLYN, N. Y.—The Coney Island & Brooklyn Railroad has decided to issue the $1,500,000 of new stock authorized a short time ago, to stockholders at par. The proceeds are to be used for the improvement of the property, including the building of new power plants. The new stock issue raises the capital outstanding from $2,000,000 to $3,500,000.

ALBANY, N. Y.—The state board of railroad commissioners has consented to the issuance by the Bennington & North Adams Street Railway Company of a mortgage of $450,000 under condition that the mortgage now authorized of the Bennington & Hoosick Valley Railway Company for $250,000 be cancelled and the bonds now outstanding, amounting to $182,000, be cancelled.

MONTPELIER, VT.—Ex-Mayor Frank M. Corry, Edward H. Deavitt, state treasurer, and I. M. Frost, formerly superintendent of the Vilas Electric Company, have purchased a controlling interest in the Barre & Montpelier Traction and Power Company, which operates the electric railroad between this city and Barre. The price paid is not made public but it is said to be between $225,000 and $250,000.

SPRINGFIELD, OHIO—Stacey B. Rankin has been appointed receiver for the Washington Traction Company by Judge A. H. Kunkle, his bond being placed at $250,000. The action was taken on motion of the Guaranty Title and Trust Company, of Pittsburg, in the cases of George W. Baker against the Springfield, Charleston & Washington Electric Railroad Company and William J. Ramsey against the Washington Traction Company.

CALGARY, ALBERTA—Calgary ratepayers have decided by vote to install a street-car system, the vote being three to one for the by-law submitted to the ratepayers. There is a strong probability that the road, to be built and running by the end of 1908, will be municipally owned. The city engineer and aldermen are looking over the ground, deciding on routes, but it is not thought advisable to raise the $250,000 necessary for the work now. This will be done next year.

LANSING, MICH.—The Jackson Consolidated Traction Company's lines have been purchased by the Mills-Moore-Elliott syndicate, which owns the Michigan United Railways. The Michigan United Railways controls fifteen lines, including three city systems. George W. Moore and Myron W. Mills, of Port Huron, and James R. Elliott, of Lansing, are the principal owners of the Michigan United Railways. The original capital was $1,000,000. It is now $5,000,000. Mortgages amounting to $7,000,000, running to the Knickerbocker Trust Company, embrace all outstanding accounts.

MIDDLETOWN, CT.—The project for the construction of an electric road between Moodus and East Hampton has been revived and outside capitalists have now taken hold of the undertaking. The company which holds the franchise has elected George F. Marshall, of Malden, Mass., president, and Fred M. Hoadley, of Providence, secretary and treasurer. The line will be about ten miles long. A considerable amount of capital has already been subscribed by merchants and manufacturers who would be directly benefited by the road.

KEOKUK, IOWA—Assurance is given by the promoters of the Mississippi Valley Electric Railway Company that its proposed electric railway line from Nauvoo, Ill., to Niota, Ill., and from Nauvoo to Carthage and Hamilton, Ill., and Keokuk, will be built. Major Calhoun, the consulting engineer, says that the rails for the entire line have been bought from the Lackawanna Steel Company for delivery in August and September. The contract for grading will be let on or before June 15, and the line completed about March of next year. The Hancock county board of supervisors has granted the company the right to cross all roads along the proposed route of the interurban line in Hancock county outside of the incorporated city limits of Carthage, Elvaston, Hamilton and Nauvoo.

SAN FRANCISCO, CAL.—Richard Hotaling, W. M. Rank and their associates have made a deal with a Baltimore syndicate by which an electric railroad system is to be built in Marin, Sonoma, Napa and Lake counties, with ferryboat connection with this city. The deal includes the purchase of the Petaluma & Santa Rosa electric road. The proposed system will enter the territory of the Northwestern Pacific in Marin and Sonoma counties and that of the Southern Pacific in Sonoma and Napa counties. The undertaking involves an expenditure of between $10,000,000 and $15,000,000. Hotaling, Rank and their associates already have a terminal on Richardson's Bay, just across from Sausalito, and they have made surveys from it to San Rafael, thence to Novato and Napa, and thence to Lakeport. The proposed road will embrace an extension of the Petaluma line northward into the Healdsburg and Cloverdale country. Ultimately it will be extended into Lake county.

ALBANY, N. Y.—The state railroad commission has consented to the increase of its capital stock by the South Brooklyn Railway Company from $150,000 to $500,000 and to the issuance of a mortgage for $4,000,000 by the company. The commission has also consented to the issuance of a mortgage of $2,000,000 by the Canarsie Railroad Company and to the issuance of a mortgage by the Sea Beach Railway Company for $2,000,000. The Brooklyn Rapid Transit Company has entered into an agreement with the three companies to furnish within the next ten years such moneys as each of these companies shall require for extensions, additions and improvements and to take in exchange therefor certificates of indebtedness of such companies, payable on demand, upon the condition that not only shall the certificates of indebtedness thus to be issued and sold to the Brooklyn Rapid Transit Company, but also the certificates heretofore issued, shall be secured by the mortgages of the railroad companies issuing such certificates as collateral security.

TROY, N. Y.—Right of way has been secured between Troy and Hoosick Falls for a trolley line. It is believed that the line, which will be about twenty-five miles long, is to be a part of the system of electric roads which the New York, New Haven & Hartford company is securing in western and southern New England. The proposed trolley line will parallel the Boston & Maine to Troy. The right of way secured begins at North Hoosick and runs through Eagle Bridge, Buskirk, Johnsonville, Valley Falls, Schaghticoke and Melrose. A branch will run from Hoosick Falls to Cambridge, and another from Hoosick Falls to Pownal, Vt. At the last place connections will be obtained with the Berkshire lines from North Adams to Williamstown and Bennington, Vt. George E. Green, of Hoosick Falls, who built the line from that place to Bennington, which is now the property of the Berkshire road, acted as purchasing agent. Power for the system will be secured from the Hoosick river at Schaghticoke, where a dam and power-house are being built to develop 100,000 horse-power.

PERSONAL MENTION.

MR. LAMAR LYNDON, the well-known consulting electrical engineer, New York city, has moved from 80 William street to No 2 Rector street, with offices on the sixteenth floor.

MR. WILLIAM S. HURLEY, of Brooklyn, N. Y., has been appointed a member of the Board of Rapid Transit Commissioners of the city of New York by Mayor McClellan. Mr. Hurley is a wealthy flour merchant, and is vice-president of the Borough Bank of Brooklyn.

MR. H. W. CANNING announces that he has opened an office in Birmingham, Ala., in the Brown-Marx Building, and will represent, in the southern district, the Ball Engine Company, Erie, Pa.; the Murphy Iron Works, Detroit, Mich., and the Whiting Foundry Equipment Company, Harvey, Ill.

MR. GEORGE H. WALBRIDGE, the manager of the Lackawanna Light Company, with offices in Scranton, Pa., it is said, will resign and affiliate with prominent New York interests. The Scranton Electric Light Company, which is owned by the American Gas and Electric Company, has practically absorbed the Lackawanna Company, and George N. Tidd has been made general manager.

MR. EUGENE V. MALING, superintendent of the Shelburne Falls & Colerain Street Railway, has presented his resignation and is to sever his relations with the company June 10. Mr. Maling has made no definite plans for the future, but will probably continue in street railway work. Mr. Maling went to Shelburne Falls fourteen months ago and took the active direction of the company's affairs.

MR. C. E. WAKEMAN, for about two years superintendent of the Whitehall (N. Y.) plant of the Consolidated Light and Power Company, has resigned and accepted a similar position with the Glens Falls Electric and Gas Company of Glens Falls. He succeeds his brother, E. A. Wakeman, who goes from Glens Falls to Terre Haute, Ind. The position made vacant by Mr. Wakeman's resignation has been filled by W. F. Lord, of Glens Falls.

DR. ALEXANDER GRAHAM BELL, who has been in England for about a month, returned to this country on Sunday, May 19, on the Hamburg-American liner Amerika. Dr. Bell and his wife spent most of their time in England touring in a motor car. While visiting the old village of Braunton, Dr. Bell made quite a collection of epitaphs appearing on some of the old tombstones in the cemetery of that primitive village. Concerning his immediate plans, Dr. Bell said he was going to his laboratory at Cape Breton, and would continue a series of experiments with large motor-power kites.

OBITUARY NOTES.

MR. CHARLES FREDERICK CUTLER, of Morristown, N. J., president of the New York Telephone Company, died at the Saranac Inn, Saranac Lake, N. Y., on Saturday, May 18, in his sixty-fifth year. Mr. Cutler spent his youth in South Framingham, Mass., later traveling through the West buying grain. A number of years ago he became interested in the telephone business, and moved to Brooklyn, N. Y. He was one of the founders of the New York & New Jersey Telephone Company, of which he was president, and also became interested in the Metropolitan Telephone and Telegraph Company, now the New York Telephone Company. He was known throughout the country as one of the foremost men in the telephone business, and did much to promote its universal development. He was interested also in several banks. At his death he was a director of the Bell Telephone Company of Philadelphia, the Delaware & Atlantic Telephone and Telegraph Company, the Chesapeake & Potomac Telephone and Telegraph Company, the Hudson River Telephone Company, the Central New York Telephone and Telegraph Company, the Empire State Telephone and Telegraph Company, and the New York & Pennsylvania Telephone and Telegraph Company. The family has resided at Morristown for more than twenty years. In the death of Mr. Cutler the business and social world loses one of its most esteemed and honored members. While of a quiet nature he was recognized as one of the most potent forces in the upbuilding of the telephone industry and the great success to which his companies have attained is due in large measure to his sagacity and executive ability. On Tuesday a special train of five cars left New York over the Lackawanna Railroad bearing to Morristown as mourners a number of the most prominent telephone men in the country. The executive offices of the company were closed for the afternoon.

MR. CHARLES K. STEARNS, a well-known and highly esteemed electrical engineer, died at his home in Boston, Mass., on Monday, May 13. Mr. Stearns was forty-two years of age, and is survived by a widow. In connection with his death the following tribute has been received from one who knew him well, H. C. Spaulding: "In Charles K. Stearns the engineering profession loses one of the kind of men it can ill afford to lose; one of the men who combined in a rare degree the result of technical training, practical experience and sterling integrity. In private life and in his work the keynote of every action might fittingly be expressed in the two words, 'thoroughness' and 'sincerity.' In commercial electrical engineering, especially as applied to railroad methods and economics, many a detail of design and construction now accepted as 'standard' is due to his ingenuity and initiative. With a heart as tender as a woman's in family and personal relations, but with a conservative and coolly analytical judgment, inherited from good old New England Puritan stock, his was a rarely balanced temperament. Many a struggling salesman and contractor has good reason to remember his readiness to 'help out' on a genuine error or unfortunate business condition for which he was not responsible, but the 'shirk' or 'quitter' found him inexorable, as the record of many a railroad and power and lighting system will bear silent evidence to-day. To his friends a friend of friends; to his employers a faithful servitor; to his business associates a rare exponent of the 'square deal' in business relations; and to all who knew him a gentleman; broad in all that liberality to others means and narrow in the performance of self-manifest duty; such was the character of Charles K. Stearns."

NEW PUBLICATION.

BULLETIN OF THE BUREAU OF STANDARDS—The last two issues of the *Bulletin of the Bureau of Standards*, No. 3, Vol. II, and No. 1, Vol. III, contain a number of contributions from members of the staff which are of exceptional interest. The Bureau, for the past two years, has been giving a large amount of attention to investigations in radiation, these including studies of photometric as well as thermometric problems, and, as might be expected, a number of these articles deal with the different phases of this subject. In bulletin No. 3 of Vol. II are given two articles, one entitled "Preliminary Measurements on Temperature and Selective Radiation of Incandescent Lamps," by C. W. Waidner and G. K. Burgess, and the other, "On the Determination of the Mean Horizontal Intensity of Incandescent Lamps by the Rotating Lamp Method," by E. P. Hyde and F. E. Cady. P. G. Nutting contributes an article entitled "Purity and Intensity of Monochromatic Light Sources;" and W. W. Coblentz two articles, one on "Radiometric Investigations of Infra-Red Absorption and Reflection Spectra," and the other, "A Vacuum Radiomicrometer." Bulletin No. 1 of Vol. III has two articles dealing with this field of research, both by E. P. Hyde, one entitled "A Comparison of the Unit of Luminous Intensity of the United States with Those of Germany, England and France," and the other, "Geometrical Theory of Radiating Surfaces with Discussion of Light Tubes." All of these articles deal with subjects which are of immediate interest. Another field of research is that dealing with the calculation and measurement of inductance. E. B. Rosa contributes an article on "Revision of the Formulæ of Weinstein and Stefan for the Mutual Inductance of Coaxial Coils;" and also, in conjunction with Louis Cohen, one entitled "The Mutual Inductance of Two Circular Coaxial Coils of Rectangular Section." Dr. Rosa also contributes to bulletin No. 1 of Vol. III an article in the same line of investigation, entitled, "On the Geometrical Mean Distances of Rectangular Areas and the Calculation of Self-Inductance," and the same author has a study, "The Compensated Two-Circuit Electrodynamometer," in this number. The latter contains as well three other articles of considerable interest. F. J. Bates and J. C. Blake have a study on "The Influence of Basic Lead Acetate on the Optical Rotation of Sucrose in Water Solution," and H. N. Stokes and J. R. Cain have two studies, one entitled "On the Colorimetric Determination of Iron with Special Reference to Chemical Reagents," and the other entitled "On Sulphocyanic Acid."

NEW INCORPORATIONS.

SICKLES, OKLA.—The Sickles Telephone Company. $1,000. E. H. Noble, general manager.

ATHENS, WIS.—Athens Telephone Company, Athens. An amendment increasing its capital from $750 to $6,000.

DES MOINES, IOWA—Wesley Rural Telephone Company, of Wesley. $2,000. C. K. Horan is one of the stockholders.

SPRINGFIELD, ILL.—Chicago & Southern Traction Company, Chicago. Capital increased from $2,000,000 to $5,000,000.

SPRINGFIELD, ILL.—Berry Ice and Power Company. $25,000. Incorporators: Fred Kalich, Sears Lehmann, H. F. Hamey.

MADISON, WIS.—Automatic Telephone Company, of Milwaukee. An amendment reducing its capital stock from $50,000 to $5,000.

WOODWARD, OKLA.—The Indian Creek Telephone Company. $5,000. Incorporators: A. W. Green, Semer Mason and J. C. Steadman.

SPRINGFIELD, ILL.—Lanark Mutual Telephone Company. $12,000. Incorporators: George W. Nichol, David H. Stitzel, John R. Wolf.

OLYMPIA, WASH.—Electric Transportation Company, of Seattle. $50,000. Incorporators: C. J. Zinthes, E. M. Farmer and Robert M. Dyer.

KINGFISHER, OKLA.—The Huntsville Telephone Company. $2,700. Incorporators: M. B. Gilliland, E. M. Hale and Joseph Thomas.

CALDWELL, KAN.—The Farmers' Mutual Telephone Company, of Caldwell, operating in Oklahoma. $1,400. Thomas E. Downing, manager.

HOOKER, OKLA.—The Hooker Telephone Company. $20,000. Incorporators: N. O. Stevenson, J. C. Becker, R. B. Broder and A. C. Murphy.

SHIRLEY, OKLA.—The Shirley Rural Telephone Company. $1,000. Directors: J. M. Brown, H. G. Taylor, P. Martin and Charles Phenix.

OKLAHOMA CITY, OKLA.—The Twin Creek Telephone Company. $50,000. Incorporators: P. J. Petrasek, William P. Reding and N. J. Reding.

OLYMPIA, WASH.—Port Orchard Electric Power Company, of Port Orchard. $100,000. Incorporators: Adah M. Eubanks and Alfred S. Eubanks.

AUSTIN, TEX.—Wichita & Northwestern Telephone Company, of Wichita Falls. $10,000. Incorporators: R. E. Huff, C. A. Huff and William McGregor.

HARRISBURG, PA.—Roscoe Telephone Company, Roscoe. $5,000. Directors: B. L. Lamb, W. C. Smith, T. J. Underwood, California; J. H. Underwood, Roscoe.

MILWAUKEE, WIS.—Colby & Southwestern Telephone Company, Colby. $600. Incorporators: Louis F. Frome, Henry A. Frome and A. K. Andrews.

AUSTIN, TEX.—The Gainesville Electric Railway and Light Company. An amendment to its charter changing its name to the Gainesville Traction Company.

DELAWARE, OHIO—The Delaware Water Power and Realty Company. $20,000. Incorporators: Thomas J. Griffin, J. F. Gaynor, E. F. Gwynn and J. G. Rosenthal.

CORTLAND, N. Y.—Cortland County Lighting Company. $250,000. Directors: Joe J. Hatch, Arthur McCausland, J. A. Byrne, of New York; W. J. Bagnell and L. B. Grant.

BURLINGTON, OKLA.—The North Union Telephone Company. $10,500. Incorporators: Henry Welsh, T. Morgan, William Mahoney, Frank Veach, Joseph Fash and G. F. Keeler.

STARRUCCA, PA.—Starrucca Rural Telephone Company. $4,500. Incorporators: William H. Travis, Hale Eddy, N. Y.; George F. Brooker and A. W. Larrabee, Starrucca, Pa.

DRIFTWOOD, OKLA.—The Citizens' Telephone Company. $3,500. Incorporators: H. J. Kraigh, J. W. Gass, A. C. Hoeffer, W. E. Barkley, W. H. Cloyd and S. C. Lambert.

JACKSON, MISS.—The Mississippi Independent Telephone and Telegraph Company, of Meridian. $50,000. Incorporators: S. A. Jones, W. N. Ethridge, C. B. Luck and others.

KENOSHA, WIS.—Kenosha Electric Railway Company, Kenosha, An amendment increasing its capital from $150,000 to $1,000,000, and its directorate from three to five directors.

RICHMOND, VA.—The Appomattox Telephone Company. $5,000. Incorporators: H. D. Flood, S. L. Ferguson, J. R. Horsley, J. R. Atwood, B. F. Oden, secretary and treasurer, all of Appomattox,

CAPRON, OKLA.—The Capron Telephone Company. $7,000. Incorporators: F. J. Fask, J. M. Daughety, Charles E. Curran, Charles Swartz, J. C. Welker, William Webb and E. U. Anderson.

PIERRE, S. D.—Wagner, Lake Shore & Armour Traction Company. To construct an electric line from Wagner to Mitchell, a distance of sixty-five miles, with a branch to Lake Andes. $1,000,000.

ALBANY, N. Y.—Wythe Electric Light, Power and Warehouse Company, Brooklyn. $300,000. Directors: Arthur Iselin, Lincoln Cromwell, G. H. Blish, W. H. Bennett and Isadore Katzerberger, of Brooklyn.

ROCHESTER, N. Y.—H. B. Pulver Company. $5,000. To conduct a gas and electric supply and manufacturing business, also to buy and sell real estate. Directors: Homer B. Pulver, George W. Winkleman and Edward M. Weidert.

JERSEY CITY, N. J.—Chenango Valley Electric Railway Company. To build and maintain an electric road between North Hamilton and Binghamton, N. Y. $100,000. Incorporators: H. O. Coughlan, L. H. Gunther and John R. Turner.

ALBANY, N. Y.—The Syracuse & Chittenango Company, of Syracuse. To operate an electric street surface road from Syracuse to Chittenango, Madison county, a distance of eighteen miles. $500,000. Directors: W. H. Dowe and G. S. Terry, of New York, and C. B. Everson, of Syracuse.

HOUGHTON, MICH.—Calumet Electric and Improvement Company, of Calumet and Lake Linden. To produce and supply electricity for lighting and other purposes, business to be conducted in Calumet and Lake Linden. $100,000. Stockholders: John Daniell, Richard Edwards, William Oates, all of Laurium.

TOPEKA, KAN.—Kansas City, Lamar & Denver Railroad Company. To build either a steam or electric line from Concordia to Salina. $100,000. Incorporators: T. E. Bacus, Kansas City, Mo.; E. R. Mackie, Concordia; John Reafsnyder, Delphos; J. C. Mason, Meredith; R. H. Burns, Lamar and W. H. Burns, Lamar.

HARRISBURG, PA.—Elizabethtown & Deodate Street Railway Company. To run from Elizabethtown through Hockerville to Conewago township and Deodate, a distance of six miles. $36,000. M. S. Hershey, of Hershey, president. Directors: W. H. Lebkicher, John E. Snyder, Lancaster; S. C. Stecher, Hummelstown, and C. S. Maulfair, Annville.

GRAND RAPIDS, MICH.—Vincennes Electric Company. Organized for the purpose of producing, furnishing and selling electric light and power, with offices at Boston, Mass.; Vincennes, Ind., and Grand Rapids. $5,000, of which $2,500 is subscribed and $1,000 is paid in. Stockholders: Frank G. Dean, Raymond E. Preble and F. D. A. Stevens, all of Grand Rapids.

MONTGOMERY, ALA.—Sand Mountain Electric Company, with headquarters at Albertville. To generate steam and electric power at Short Creek, near Albertville, to sell it to cities and towns within a radius of fifty miles, and to build and operate a railroad from Gadsden to Scottsboro. $50,000. Incorporators: Leon C. McCord, secretary to the Supreme Court; E. O. McCord, Rena B. McCord, C. M. E. Mann, W. E. Snead and J. B. Roberts, Montgomery.

YORK, PA.—York Telephone and Telegraph Company, a corporation which has absorbed the York Telephone Company. $500,000. Directors: D. F. Lafean, G. B. Rudy and William S. Eisenhart. The charter gives the right to the company to maintain a system of telephone and telegraph lines, exchanges and stations in Philadelphia, Montgomery, Delaware, Chester, Lancaster, York, Dauphin, Cumberland, Adams, Franklin, Huntington, Fulton, Bedford, Somerset, Westmoreland, Fayette, Washington and Allegheny counties.

TELEPHONE AND TELEGRAPH.

LANDIS STORE, PA.—The Mountain Telephone Company held a meeting recently and organized by naming thirteen directors, a president, treasurer and other officers, to serve during the ensuing year. The company has its principal office at this place.

LOS ANGELES, CAL.—Clarence H. Mackay, president of the Postal Telegraph Company, announces that the company will soon commence the construction of a new route beginning at Salt Lake City and ending at San Francisco. At a point midway, probably at Reno, a connecting route will be run south into Nevada, touching Goldfield, Tonopah, Manhattan, Rhyolite, Beattie and other towns, to a point on the main line of the Santa Fe. One thousand or 1,200 miles of new line will be constructed at an approximate cost of $1,000,000.

CANASTOTA, S. D.—As the result of a meeting held by a number of the farmers residing in this vicinity it was decided to organize a rural telephone company, which will be incorporated under the name of the Farmers' Telephone Company No. 2. The following officers were elected: president, M. E. Mitchell; vice-president, Samuel Morrow; secretary, John Parsons; treasurer, Charles Kostboth. The work of constructing the new system will commence as soon as the material is received. Arrangements have been made to make connection with the Canastota central office.

OMAHA, NEB.—The Independent Telephone Company has filed with the county clerk a mortgage to secure the issue of $3,300,000 of bonds recently authorized by the corporations. The mortgage covers all of the real and personal property of the company, including the franchises, conduits and other appliances and runs to the Title Insurance and Trust Company, of Los Angeles, Cal., in trust for the bondholders. At a meeting of the stockholders of the company the same officers and directors were reelected for the coming year. The officers are U. S. Grant, Jr., of San Diego, president; F. H. Stow, vice-president; F. S. Graves, secretary, and C. E. Bittinger, treasurer. The directors of the company are: W. F. Ely and F. H. Stow, of Omaha, and U. S. Grant, Jr., of San Diego, Cal. The work of installing the Omaha plant is now under way.

PORTLAND, ME.—The Atlantic Telegraph Company, which formerly operated its lines between Boston and Portland, with intermediate offices at Charlestown, Arlington, Lowell, Lawrence and Haverhill, in Massachusetts; Portsmouth and Dover, in New Hampshire, and South Berwick, Wells, Kennebunk, Biddeford, Old Orchard and other coast resorts in Maine, is to again open offices. These lines and offices have been under lease, first to the Baltimore & Ohio Company, and, second, to the Western Union Company, for the past twenty years. At a meeting of the stockholders it was decided to take over and again operate the plant, independent of any other company, and to reenter the field as a competitor for telegraph business. At the meeting of the Atlantic Telegraph Company's stockholders mentioned above, Robert Morton, formerly with the Western Union Company, at New York city, was elected general manager of the Atlantic Telegraph Company, with headquarters at Lowell, Mass.

ELECTRICAL SECURITIES.

The stock market last week was almost featureless, trading being the dullest for any period in some time. Sentiment is naturally bearish, with, however, the market showing good resistance to adverse tendencies. Much of this resistance is thought to be due to support by banking and other big interests, which have not unloaded all the stocks taken over in the March collapse, when buying became the order of the day to prevent a complete upset. This attitude is more or less a guarantee against any very serious decline, although no doubt the tendency will be for the market to sag for some little while, and, of course, no set of men can absolutely control the effects of an extremely bad crop outlook. Notwithstanding the dominant influence generally accredited to the nation's agriculturals at this season of the year, and the untoward weather conditions which render estimates of little value, the demand for fresh money continues in all quarters. If, as has been stated, this money is put into construction, it should mean a busy summer with plenty of small cash in the pockets of the common people all next winter. The manufacturers continue enlarging their plants to keep up with the present demand. Even if this should drop off it is likely that sufficient has been held out from the profits to stimulate further interest and create new demands.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MAY 11.

New York:	*Closing.*
Allis-Chalmers common	11⅞
Allis-Chalmers preferred	30⅛
Brooklyn Rapid Transit	58⅛
Consolidated Gas	131½
General Electric	142
Interborough-Metropolitan common	19¾
Interborough-Metropolitan preferred	54⅛
Kings County Electric	126
Mackay Companies (Postal Telegraph and Cables) common	71
Mackay Companies (Postal Telegraph and Cables) preferred	69½
Manhattan Elevated	138
Metropolitan Street Railway	94
New York & New Jersey Telephone	113½
Western Union	82¼
Westinghouse Manufacturing Company	146

Directors of Consolidated Gas have declared the regular quarterly dividend of 1 per cent payable June 15. Books close May 27 and reopen June 15.

Notice is given that pursuant to the voting trust agreement dated May 14, 1902, holders of the stock trust certificates of the Interborough Rapid Transit Company issued thereunder, upon presentation of the same duly indorsed at the office of August Belmont & Company, 23 Nassau street, New York city, will be entitled to receive certificates for the capital stock of the Interborough Rapid Transit Company for such voting trust certificates surrendered for exchange.

The reports of earnings of the operating companies of the Brooklyn Rapid Transit Company for the quarter ended March 31, 1907, taken together, show an increase of 4.51 per cent in gross earnings, as compared with the corresponding quarter for 1906, but also an increase of 11.81 per cent in operating expenses and accordingly a decrease of 7.12 per cent in net earnings. Other income shows a large decrease and as charges remain about the same the surplus shows a falling off of 88.99 per cent. These reports reflect the unfavorable weather of the winter. The cost to the company of removing snow is estimated at $100,000, as compared with only a nominal amount the previous winter, while operating expenses were otherwise increased.

Boston:	*Closing.*
American Telephone and Telegraph	123
Edison Electric Illuminating	215
Massachusetts Electric	61
New England Telephone	117
Western Telephone and Telegraph preferred	70

The American Telephone and Telegraph Company's instrument statement for April is as follows: gross output, 147,066; returned, 178,639. The decrease is due to the inclusion of 87,059 instruments destroyed in San Francisco as the result of the earthquake in the item "returned." The net output for the first four months of the present year is 249,615. The total now outstanding is 7,357,451.

Philadelphia:	*Closing.*
Electric Company of America	10
Electric Storage Battery common	50
Electric Storage Battery preferred	50
Philadelphia Electric	8½
Philadelphia Rapid Transit	24½
United Gas Improvement	92

Chicago:	*Closing.*
Chicago Telephone	128
Chicago Edison Light	140
Metropolitan Elevated preferred	64¾
National Carbon common	70
National Carbon preferred	114⅞
Union Traction common	—
Union Traction preferred	—

The Central Trust Company of Illinois has been made trustee for the first mortgage bonds of the Lake Street Elevated, now the Chicago & Oak Park line, succeeding the Equitable Trust Company, one of the defunct Walsh institutions.

Metropolitan Elevated traffic the first half of May averaged 151,986 passengers daily, an increase of 12,069. Northwestern Elevated's new Ravenswood extension will add to its traffic 15,000 to 20,000 passengers daily. Twenty new cars have been secured.

EDUCATIONAL NOTE.

SYRACUSE UNIVERSITY—The College of Applied Science at Syracuse University, Syracuse, N. Y., offers courses in civil engineering, electrical engineering and mechanical engineering. The main building, erected in 1902, is the gift of Lyman Cornelius Smith, of Syracuse. Mr. Smith has recently erected another building for metal and wood-working machines, foundry, hydraulic laboratory, forges, etc. A summer school will be held at the university for six weeks, from July 5 to August 16. The courses will include, among others, mathematics, physics and chemistry.

LEGAL NOTE.

STANLEY TRANSFORMER PATENT—The United States Circuit Court of Appeals for the Second Circuit at New York in a recent decision held that the transformer patent No. 469,809 issued to the Westinghouse Electric and Manufacturing Company as assignee of William Stanley, Jr., and well known as the Stanley transformer patent, is valid and is infringed by the transformer of the Wagner Electric Company, of St. Louis, Mo. The decision of the court gives to the patent such a scope as to include the usual multiple arc system of constant potential transformers having the self-regulating capacity to deliver practically a constant voltage at all loads and requiring only a small primary or leakage current at no load.

NEW MANUFACTURING COMPANIES.

ALBANY, N. Y.—The Overland Electric Company, of Syracuse, to manufacture car heating devices, has been incorporated. The capital is $100,000. One of the directors is T. Arthur Whitaker, of Albany.

NEW YORK, N. Y.—The Telephone Call Recorder Company, New York, has been incorporated to manufacture telephone apparatus with a capital of $50,000. The incorporators are: J. H. Thompson and William H. Fulton, Plainfield, N. J.; Robert D. Lampson, New York city.

DOVER, DEL.—The state department has issued a certificate of incorporation to the Vandegrift Company. The new concern will engage in boat building and the construction of gas and electric motors and plants. The incorporators are of Philadelphia, and the capital is $100,000.

DOVER, DEL.—The Hite Electric Company has been incorporated to deal in galvanic and electrical fittings and apparatus for general electrical purposes. The incorporators are: F. R. Hansell, Philadelphia; George H. B. Martin, Camden, N. J., and S. C. Seymour, Camden, N. J. The capital stock is $1,000,000.

INDUSTRIAL ITEMS.

THE FERRACUTE MACHINE COMPANY, Bridgeton, N. J., has published a small catalogue listing about 500 kinds and sizes of foot and power presses.

THE STRANG GAS-ELECTRIC CAR COMPANY, 15 Wall street, New York city, has published a handsome bulletin descriptive of the Strang railway car.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, Minneapolis, Minn., has published a handsome catalogue descriptive of the "Twin City" Corliss engine.

JOHN L. GLEASON, 290 South street, Jamaica Plain Station, Boston, Mass., has ready for distribution some descriptive literature and price lists of "Fancleve" electrical specialties.

THE SCHAEFFER & BUDENBERG MANUFACTURING COMPANY, New York city, has ready for distribution some interesting literature concerning its non-magnetic tachoscopes and tachometers.

THE PAN-ELECTRIC SERVICE AND APPLIANCE COMPANY, INCORPORATED, St. Louis, Mo., announces that its offices will be located hereafter at the northwest corner of Fourth and Gratiot streets.

MANUEL LLERA, New York city, announces his removal to the United States Express Building, No. 2 Rector street. Mr. Llera makes a specialty of complete power plants and general power supplies.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., is distributing some very interesting and attractive literature devoted to its direct and alternating-current fans.

THE BLISS ELECTRIC CAR LIGHTING COMPANY, Milwaukee, Wis., has secured an order from the Baltimore & Ohio Railroad to light the Royal Blue Limited trains with the Bliss system of electric car lighting.

THE AMERICAN CONDUIT COMPANY, New York city, is mailing a series of cards bearing testimonials from engineers in various parts of the country concerning the utility of the American Conduit Company's product.

THE ELECTRO-DYNAMIC COMPANY, Hanover Bank Building, New York city, with works at Bayonne, N. J., will be pleased to send its new catalogue devoted to "Inter-Pole" variable-speed motors for machine-tool drive.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., in leaflet No. 2,002, illustrates the valve gear, piston details and governor of the Reynolds Corliss engine. This leaflet is to facilitate the ordering of repairs and spare parts.

THE ARNOLD COMPANY, 181 La Salle, street, Chicago, Ill., in Arnold bulletin No. 17, describes the system of the Elgin & Belvidere Electric Railway. Copies of this bulletin will be sent to any one interested upon request.

THE FOSTORIA GLASS SPECIALTY COMPANY, Fostoria, Ohio, is distributing some attractive literature calling attention to the "Noblac" inner globes. The company will be pleased to send its circulars of information upon request.

THE MOORE ELECTRICAL COMPANY, Newark, N. J., has sent *via* the Hamburg-American liner Deutschland two men and apparatus for two installations of the Moore light in one of the largest automobile garages in Europe, located in London. This is the first foreign installation of the Moore light.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has ready for distribution the tenth edition of its price list "X," which describes the Exide type of battery in electric vehicle and sparking service. Copies of this price list will be forwarded on application to any of the sales offices of the company or to any of its Exide depots.

R. D. WOOD & COMPANY, Philadelphia, Pa., has published a new catalogue descriptive of centrifugal pumps for waterworks and high-pressure fire service. The company states that facts and figures not hitherto available to the general public are given in this catalogue. The rapidly extending uses of the high-lift centrifugal pump will make these data very interesting.

THE ABNER DOBLE COMPANY, San Francisco, Cal., has appointed Mitsui & Company to act as its sole agent in Japan and the latter company's territory, including Corea, China and Manchuria, for the sale of Doble tangential water-wheels and hydraulic apparatus. Mitsui & Company is the largest and most progressive engineering house in the Far East, and has thirty-five branch offices.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has published some interesting literature, among which are an approximate rule for the size of wires for three-phase transmission lines; price list No. 5,163, on "Gem" regular incandescent units and "Gem" Meridian units; price list No. 5,164, on Thomson recording wattmeters; a flier describing adjustable terminal ground connectors; a blotter calling attention to General Electric lightning arresters; bulletin No. 4,494, devoted to Edison "Gem" high-efficiency incandescent units; bulletin No. 4,494B, form P belt-driven alternators; No. 4. 497, "Security" snap sockets, and bulletin No. 4,500, constant-current transformer panels.

THE SIROCCO ENGINEERING COMPANY, New York city, has established an office in the new West Street Building, 140 Cedar street. This company has been incorporated in New Jersey for the purpose of taking over the American manufacturing rights of the Sirocco Engineering Works, of Belfast, Ireland. The capital of the new company is $500,000. A temporary plant will be erected at

the Bush Terminal Stores, South Brooklyn, until permanent works, which will be erected near New York city, are available. The plant is to be devoted to turning out ventilating fans, blowers, engines, pumps and other apparatus made at the Belfast works. Samuel C. Davidson, of Davidson & Company, owner of the Belfast works, is president of the company. The vice-president is William C. Redfield, formerly president of J. H. Williams & Company, of Brooklyn.

Record of Electrical Patents.

Week of May 14.

853,216. METHOD OF AND APPARATUS FOR MEASURING ELECTRIC CURRENTS. Otto T. Bláthy, Budapest, Austria-Hungary. Different portions of the core are worked at different intensities of magnetization.

853,218. ELECTRIC MOTOR. William M. Bradshaw, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A magnetizable core has a projecting salient pole flanked by two poles of opposite polarity.

853,219. TERMINAL BLOCK FOR ELECTRICAL APPARATUS. William M. Bradshaw, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A box with divergent openings.

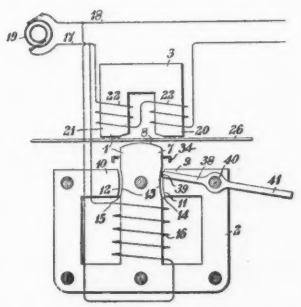
853,220. ELECTRIC SWITCH. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Two switches operated alternately by the vertical reciprocating motion of a spindle.

853,226. ALTERNATING-CURRENT ELECTRICAL APPARATUS. Frank Conrad, Edgewood Park, and William M. Bradshaw, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. The main projecting pole of the core lies between facing poles of opposite polarity.

853,231. MULTIPLE SOCKET FOR INCANDESCENT LAMPS. Elias L. Elliott, New York, N. Y. A contact piece for the lamps is contained in an insulating base.

853,238. SLACK-ADJUSTER FOR ELECTRIC LAMPS. Harrison M. Groash, St. Louis, Mo.; Harry Troll, public administrator of said Harrison M. Groash, deceased. A vertical drum.

853,285. DYNAMOELECTRIC MACHINE. William L. Waters, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. A method of attaching pole-pieces.



853,218.—ELECTRIC MOTOR.

853,286. TELEPHONE TRUNKING SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A disconnecting signal, source of current and relay are associated with the incoming end of the trunk.

853,287. SUPERVISORY SIGNALING SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. The source of current is permanently connected to both sides of a talking circuit.

853,291. TELEPHONE SYSTEM. Garrison Babcock, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. A party-line system.

853,292. CIRCUIT-CHANGING APPARATUS. Jules A. Birsfield, Rochester, N. Y., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. A relay.

853,296. ELECTRIC FUSE OR CUT-OUT. Leonard B. Buchanan, Woburn, Mass. An enclosed fuse.

853,301. DEVICE FOR CONTROLLING THE OUTPUT OF A GENERATOR. Ethelbert T. Ford and William F. Bauer, St. Louis, Mo., assignors to St. Louis Car Lighting Company, St. Louis, Mo. A system for train lighting or the like.

853,304. TELEPHONE EXCHANGE SYSTEM. Arthur R. Kahl, Rochester, N. Y., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. A manual system.

853,305. CIRCUIT-CHANGING APPARATUS. William Kaisling, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. A polarized relay.

853,322. TROLLEY HARP. Edward D. Rockwell, Bristol, Ct., assignor, by mesne assignments, to the New Departure Manufacturing Company, Bristol, Ct. The harp has a limited rocking movement.

853,333. COIL-CLAMP FOR ROTARY MAGNETS. Charles A. Backstrom, Milwaukee, Wis., assignor to Backstrom-Smith Steam Turbine and Manufacturing Company. A clamp for high-speed magnets.

853,337. BREAST TRANSMITTER. Jules A. Birsfield, Rochester, N. Y., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. A telephone transmitter.

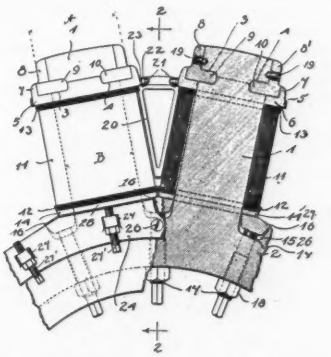
853,340. WINDING FOR ELECTROMAGNETS. William M. Bradshaw, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A loop with a bar that extends from one side of the loop and partially across the area included thereby.

853,351. ELECTRIC BRAZING MACHINE. Weston M. Fulton, Knoxville, Tenn., assignor to the Fulton Company, Knoxville, Tenn. Employs two steam heating bars.

853,352. PORTABLE BATTERY LAMP. Stephen W. Gibbs, Jr., Frankfort, Ky. A combined lamp and music stand.

853,370. SPRING JACK FOR TELEPHONE SWITCHBOARDS. Frank R. McBerty, Evanston, and Edward B. Craft, Chicago, Ill., assignors to Western Electric Company, Chicago, Ill. The parts are stamped from a single piece of metal.

853,373. REGISTERING SYSTEM FOR TELEPHONE EXCHANGES. Arthur R. Pollock, Piqua, Ohio. A registering device is operated by a drop actuated by the telephone.



853,285.—DYNAMOELECTRIC MACHINE.

853,374. SYSTEM OF DISTRIBUTION. Karl C. Randall, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. The primary and secondary coils are star-connected; a group of auxiliary coils is delta-connected.

853,375. COOLING AND VENTILATING SYSTEM. Karl C. Randall, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. The cooling means is automatically regulated by the load on the apparatus.

853,389. TELEPHONE CALLING OR SIGNALING DEVICE. Klas Weman, Buffalo, N. Y. A magnet with two windings.

853,403. ELECTRIC BLOCK SYSTEM FOR RAILWAYS. Walter R. Fuller, Atlanta, Ga. The signals are operated from batteries on the train.

853,444. HANGER FOR INCANDESCENT LAMPS. Maximilian J. Diemmer, Augusta, Ga. The drop cord is coiled on a drum within the canopy.

853,464. COMMUTATING ELECTRIC MOTOR. Ralph D. Mershon, New York, N. Y. The desired distribution of magnetic flux is procured by feeding current into one of the elements at a plurality of points for each pole.

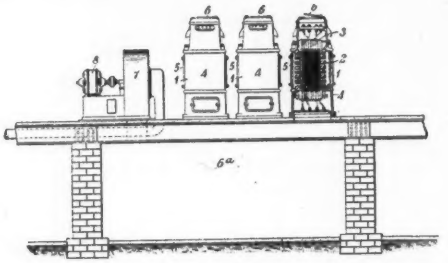
853,465. INDUCTION MOTOR AND GENERATOR. Ralph D. Mershon, New York, N. Y. A rotating electrolytic condenser is attached to the rotor.

853,475. ELECTROMAGNETIC MACHINE OR CONCENTRATOR. John H. Ryan, Portland, Ore., assignor of one-third to O. B. Stubbs and one-third to Charles N. Ryan, Portland, Ore. A magnetic separator.

853,491. SINGLE-PHASE ALTERNATING-CURRENT MOTOR WITH COMMUTATING POLES. Englebert Arnold, Karlsruhe, Germany, and Jens Lassen La Cour, Edinburgh, Scotland. A compensation winding is placed in slots in the main poles.

853,492. PROCESS AND DEVICE FOR CONTROLLING ELECTRIC CIRCUITS. Heinrich Beck, Meiningen, Germany. A wire with a high temperature coefficient of resistance enclosed in an exhausted tube.

853,550. ELECTRIC MACHINE. Coloman de Kando, Budapest, Austria-Hungary. A molten insulating substance is poured around the windings and allowed to solidify.



853,375.—Cooling and Ventilating System.

853,578. TELEPHONE RECEIVER. Abner F. H. Davis, Oakland, Cal., assignor to the National Telegraphone Company, Rochester, N. Y. The diaphragm is of non-magnetic, but highly conductive, material.

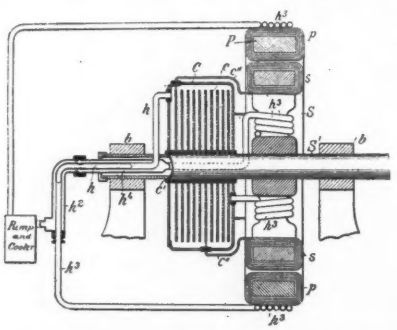
853,579. ALARM SIGNAL. Ellsworth E. Flora, Chicago, Ill., assignor to Zorge Safety Railway Equipment Company, Chicago, Ill. An automatic track torpedo-placing device.

853,645. VIBRATORY APPARATUS FOR EAR TREATMENT. Eugene Meyer, New York, N. Y. Vibrations are produced by an electromagnet.

853,648. ELECTRIC CLOCK. Timothy B. Powers, New York, N. Y., assignor to Kutnow Bros., New York, N. Y. The oscillating wheel is kept in motion by momentary magnetic impulses.

853,655. PROTECTIVE MEANS FOR PARALLEL FEEDERS. Charles W. Stone, Schenectady, N. Y., assignor to General Electric Company. The opening of the feeder circuit-breakers opens breakers in the bus-bars.

853,678. VAPOR ELECTRIC APPARATUS. William R. Burrows, Newark, N. J., assignor to General Electric Company. The anode is grooved to provide a large superficial area.



853,465.—Induction Motor and Generator.

853,682. TELEPHONE TRUNKING SYSTEM. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A manual system.

853,688. ELECTRIC CONTROLLING SWITCH. Wilhelm Gminder, New York, N. Y. The switch is operated by air heated by a thermo junction.

853,694. ELECTRICAL SAD-IRON HEATER. Charles Van Dyke Hill, St. Louis, Mo. An electric heater for attachment to ordinary irons.

853,710. ELECTRICAL ADVERTISING CLOCK. John H. Melchers, Decatur, Ill. A flexible strip of advertisements is passed before a suitable opening in the case.

853,711. MOTOR CONTROL. Wilbur L. Merrill, Schenectady, N. Y., assignor to General Electric Company. Motors designed for different speeds and different voltages are attached to the same machine.

853,743. INSULATING DEVICE. Louis Steinberger, New York, N. Y. A composite pin.

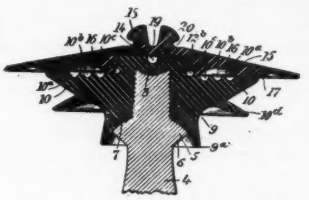
853,744. HIGH-TENSION INSULATOR. Louis Steinberger, New York, N. Y. An insulator reinforced by supporting ribs.

853,745. HORIZONTAL SUPPORT FOR CONDUCTORS. Louis Steinberger, New York, N. Y. A ribbed insulator.

853,755. APPARATUS FOR TRANSMITTING TO A DISTANCE REAL OPTICAL IMAGES. Edouard Belin, Paris, France. Employs selenium elements.

853,771. LUBRICATOR FOR TROLLEY WHEELS. James F. Cottrell, Rochester, N. Y. The hub is hollow for carrying lubricant.

853,778. TRANSFORMER. John J. Frank, Schenectady, N. Y., assignor to General Electric Company. Regulating leads are provided near the centre of the winding.



853,744.—High-Tension Insulator.

853,779. THREE-PHASE TRANSFORMER. John J. Frank, Schenectady, N. Y., assignor to General Electric Company. The axis of one coil is at right-angles to that of the other two.

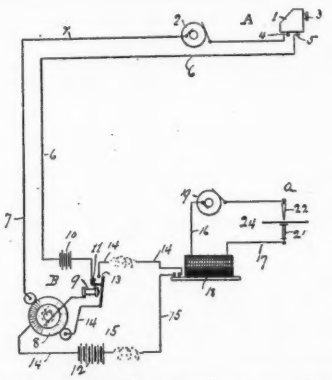
853,780. SWITCH-CONTROLLING MECHANISM. Henry Geisenhöner, Schenectady, N. Y., assignor to General Electric Company. The switch is operated by the windage of the rotor.

853,784. RESISTANCE UNIT. Harry E. Heath, Lynn, Mass., assignor to General Electric Company. The resistance conductor is secured to a sheet of insulating material by projecting loops.

853,789. MERCURY METER. Frank Holden, London, England, assignor to General Electric Company. The mercury is moved by a motor-driven pump.

853,790. ELECTRIC MEASURING INSTRUMENT. Frank Holden, London, England, assignor to General Electric Company. The reading is given by the height of a liquid in a gauged tube.

853,818. AUTOMATIC TELEPHONE SYSTEM. Friedrich Merk, Berlin, Germany. An automatic exchange.



853,755.—Apparatus for Transmitting to a Distance Real Optical Images.

853,826. FIRE ALARM OR TEMPERATURE INDICATOR. Micajah L. Poulter, Stockport, Iowa. The alarm is operated by the expansion of air.

853,829. THERAPEUTIC AND OTHER ELECTRIC LAMPS. Charles. M. Robinson, New York, N. Y. A lamp shade.

853,838. CURRENT COLLECTOR. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to General Electric Company. A pantagraph collector controlled by fluid pressure.

853,843. TRANSFORMER. Matthew O. Troy, Schenectady, N. Y., assignor to General Electric Company. Cooling pipes are run in angles of the core.

853,855. DESK TELEPHONE AND SWITCHING MECHANISM. Albert K. Andriano, San Francisco, Cal., assignor to Direct-Line General Telephone Company, San Francisco, Cal. A desk telephone set.

853,871. ELECTRIC-LAMP HANGER. Adam S. Elliott, Peterborough, Ontario, Canada, assignor of one-half to Charles Smith Botsford, Peterborough, Canada. A spring-driven drum.

853,877. BATTERY ELEMENT. Olin F. Harvey, Wilkes-Barre, Pa. Blocks of active material are clamped in a frame.

853,888. SYSTEM FOR ELECTRICAL DISTRIBUTION. Richard C. Leake, Auburn, N. Y., assignor of one-half to Dwight J. Strickland, Auburn, N. Y. A plurality of working circuits is provided, and means of controlling the supply to them.

853,891. ELECTRIC RESISTANCE ELEMENT. Albert L. Marsh, Lake Bluff, Ill., assignor to the Hoskins Company, Chicago, Ill. A strip formed of an alloy of nickel and vanadium.

853,892. ELECTRIC WATER HEATER. Edward C. Miles, Denver, Col. The heating coil is carried on a porous diaphragm.

853,929. WIRELESS TELEGRAPHY. Walter W. Massie, Providence, R. I. Employs a magnetic detector.